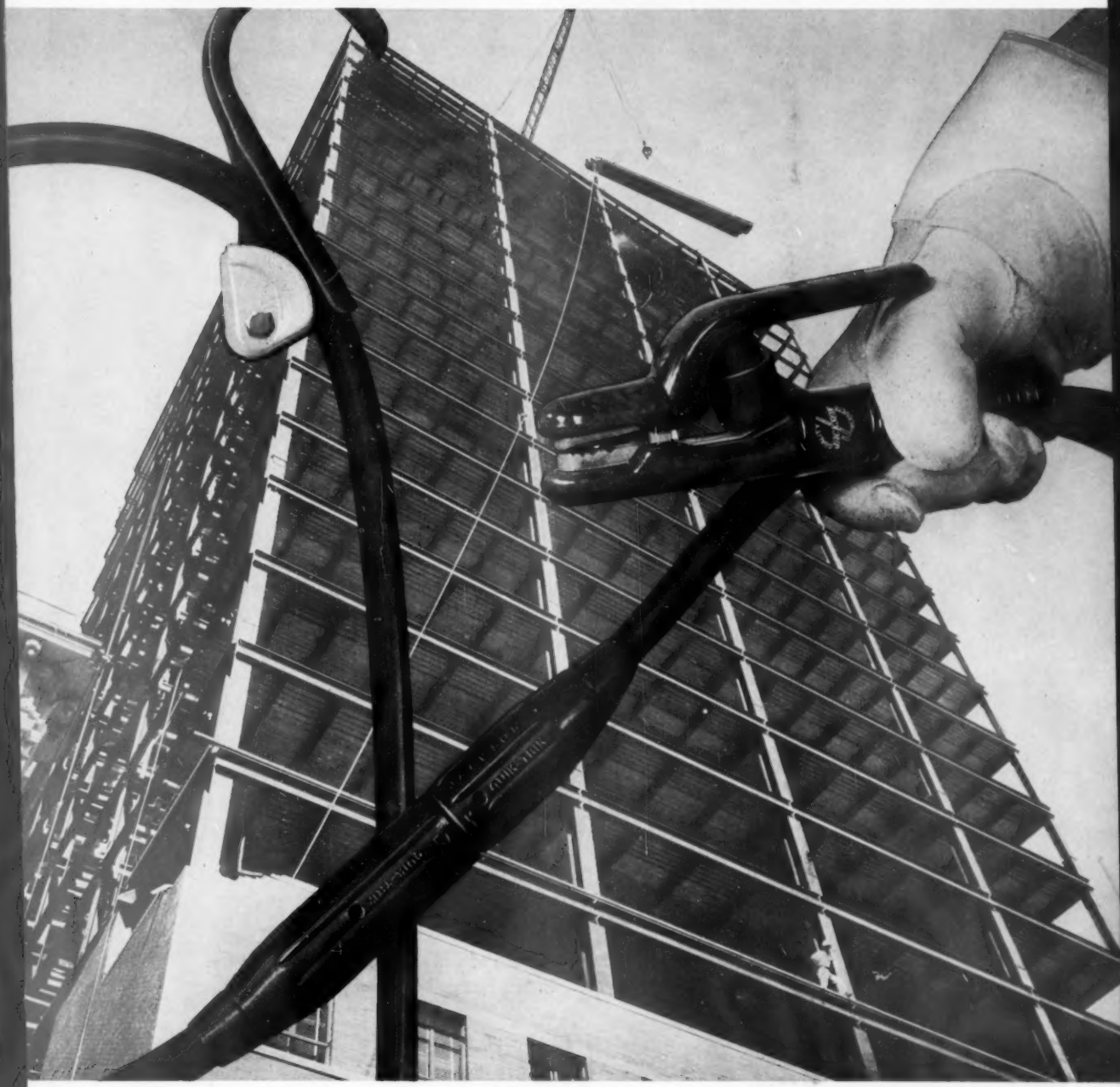
Welding Engineer

PRICE 50 CENTS

JUNE, 1959

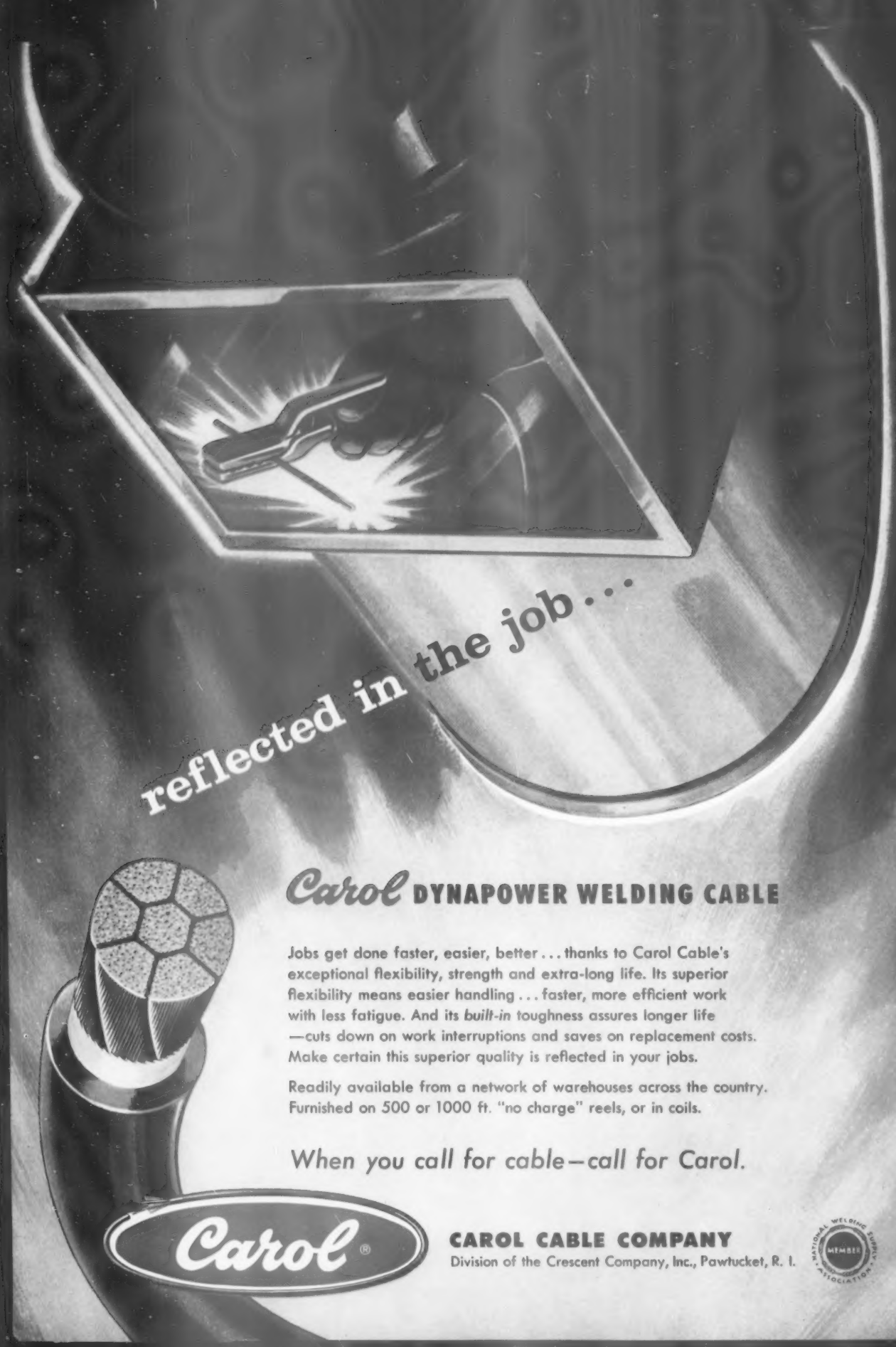


Three great tools for construction workers: the Jackson insulated electrode holder, the 'Quik-Trik' cable connector with neoprene rubber insulators, and the new 'Cablehitch' for overhead suspension of welding cable, gas or air hose.

Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

WARREN • MICHIGAN



Carol DYNAPOWER WELDING CABLE

Jobs get done faster, easier, better . . . thanks to Carol Cable's exceptional flexibility, strength and extra-long life. Its superior flexibility means easier handling . . . faster, more efficient work with less fatigue. And its *built-in* toughness assures longer life —cuts down on work interruptions and saves on replacement costs. Make certain this superior quality is reflected in your jobs.

Readily available from a network of warehouses across the country. Furnished on 500 or 1000 ft. "no charge" reels, or in coils.

When you call for cable—call for Carol.

Carol®

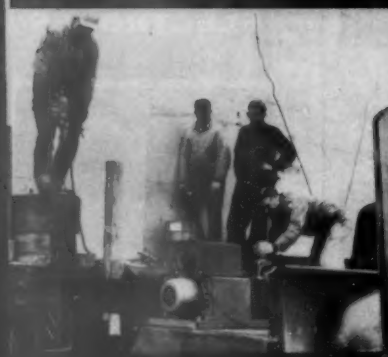
CAROL CABLE COMPANY
Division of the Crescent Company, Inc., Pawtucket, R. I.

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

WELD, RUN TOOLS LIGHTS, MOTORS anywhere

with this NEW low cost HOBART POWER/WELD

Talk about convenience—the Power/Weld supplies ample AC power to run lights, tools while the operator does DC welding.



Here is another typical example of how the Power/Weld saves time and money. The operator is drilling holes for lag bolts, immediately after he has finished welding a metal handrail that was broken in loading.

Hobart's Power/Weld gives you all the advantages of DC welding plus the additional benefit of AC current for operating all kinds of electric motor driven equipment.

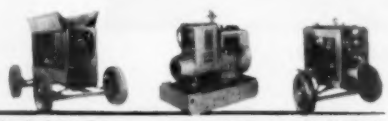
POWER/WELD: The most profitable, compact, versatile welder you can own

- **DC WELDING—30 to 225 amperes**
- **5 kw 110/220 volt AC emergency power**

Handle all types of electrodes in all positions. Choose either polarity (straight or reverse) for the best results on the job at hand. Famous Hobart controls give you a choice of 500 different welding heat combinations. You never have to shift jacks or change brush settings. A quiet running, air-cooled, two-cylinder engine makes you completely independent of power lines, and a 3¾ gallon gas tank permits extended operations.

You can run AC powered tools that are most essential to complete your work such as a magna-flux unit, a paint spray, or a coolant pump . . . without leaving your work to make adjustments at the welder. Should a power failure emergency occur, the Power/Weld will furnish 5 KW full time AC power with excellent voltage regulation on a permanent or a "stand-by" basis. Check and mail the coupon for complete details. Hobart Brothers Co., Box U-69, Troy, Ohio, Phone FE 2-1223.

for outside work
where electrical power is not available



Standard Gas Drive 300 to 600 amps. | "Husky Boy" 200 amps. | "Contractor's Special" 250 amps.

for inside work
production, maintenance and repair welding

Standard Electric Drive 200 to 600 amps. | Transformers 300 to 500 amps. | Fully Automatic Welding Heads

HOBART WELDERS · ELECTRODES

A NEW Iron Powder ELECTRODE

HOBART 12-A *(E-6012)*

for mild steel, in flat, vertical and overhead positions. This Hobart electrode is outstanding for fast production, fabrication work and maintenance jobs. Its ease of handling makes it a good general purpose electrode. To lower your welding costs—try the new Hobart 12-A.

CLIP AND MAIL TODAY!

● HOBART BROTHERS COMPANY, BOX U-69, TROY, OHIO

Please send me complete details on the items I've checked:

☐ "Power/Weld" ☐ Standard Gas Drive ☐ "Contractor's Special" ☐ "Husky Boy" ☐ Standard Electric Drive ☐ Fully Automatic Welding Heads ☐ Transformers ☐ Electrodes ☐ Accessories

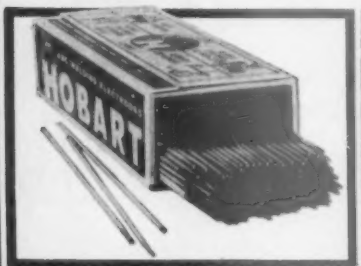
*Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

3 OUTSTANDING HOBART ELECTRODES

made under the most rigid system of laboratory testing and quality control in the industry

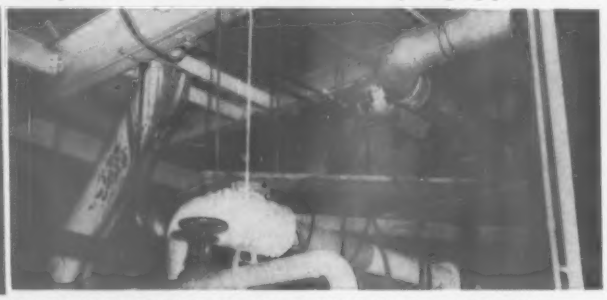


HOBART "12" AWS ASTM E-6012

FOR FAST, ALL POSITION WELDING AT HIGHER THAN NORMAL AMPERAGES

. . . your best choice is the Hobart "12." In mild steel jobs such as fabricating auto frames shown above, or in maintenance and production plants, the Hobart "12" is an ideal choice. In addition to its speed, you'll like these four outstanding features: 1. A low spatter loss saves cleanup time. 2. It operates on either AC or DC current. 3. The low smoking arc is quiet and can be "dragged" without sticking or undercutting. 4. It deposits a great amount of metal per electrode. The Hobart "12" is recommended for poor fit up work because its stable arc readily bridges gaps.

HOBART "10" AWS ASTM E-6010



FOR DIRECT CURRENT WELDING IN FLAT, VERTICAL AND OVERHEAD POSITIONS

. . . choose the Hobart "10." This outstanding electrode was used to weld the above power plant piping because of its mechanical and physical properties. It deposits a flat bead of high tensile strength, ductility, and X-ray quality. Its arc penetrates deeply. Slag is thin, brittle and easily removable. The Hobart "10" is an ideal choice wherever a weld is susceptible to flanging or cold bending and forging. It is widely used in the welding of high pressure mild steel piping, pipe lines, structural steel work, oil well casing, boilers, storage tanks, and ship construction.

"ROCKET 24" AWS ASTM E-6024

FOR GREATLY INCREASING DEPOSITION ON HORIZONTAL FILLET AND DOWNHAND WELDING

. . . the manufacturer of a large weldment realized up to 50% more deposition by using Hobart "ROCKET 24" electrodes. You'll find they open up a new field of cost savings. The coating contains iron powder which becomes a part of the weld, permits radically increased welding rates and produces an exceptionally smooth arc action. Slag curls up and away from the work—it practically removes itself. "ROCKET 24" was especially designed as a contact type electrode for fast welding using the drag technique—It may also be used with the free arc welding method.

HOBART QUALITY ELECTRODES

used by the LEADING INDUSTRIES for faster welding — higher quality welding

A SPECIAL ELECTRODE FOR EVERY TYPE OF WORK for greater strength—uniform quality and where dependable welding is a MUST.

LESS SPATTER LOSS MORE WELD DEPOSIT Lower cost welding

. . . Greater Savings **MORE PROFIT** *From Every Job*

HOBART WELDERS' ELECTRODES

HOBART BROTHERS COMPANY, BOX U-691, TROY, OHIO, Ph. FE 2-1223

"Manufacturers of the World's Most Complete Line of Arc Welding Equipment"

HOBART BROTHERS COMPANY, BOX U-691, TROY, OHIO

Yes, I'd like to try the Hobart ☐ "12" ☐ "10" ☐ "Rocket 24"

*My work is*_____

*Name*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

There's a HOBART electrode for every welding job

FOR MANUAL WELDING
- Mild Steel
- Low Alloy
- Cast Iron
- Hardsurfacing
- Stainless Steel
- Tool-N-Die
- Low Hydrogen
- Non-Ferrous

FOR AUTOMATIC and SEMI-AUTOMATIC WELDING
- Coiled and Spooled
- Mild Steel
- Low Alloy
- Hardsurfacing
- Non-Ferrous
- Flux

Vol. 44—No. 6

Welding Engineer

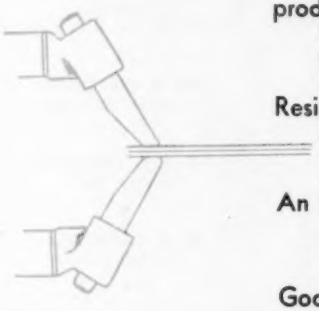
The magazine of joining and severing materials

This is welding: June, 1959

Cable prices and sales on way up, survey shows 45
In another special report, WELDING ENGINEER relates its findings on cable's future after a survey of leading manufacturers.

Flexible sheet-explosive for metal cutting 46
After the initial furor created by explosive forming and welding, the inevitable of explosive-cutting and hardening has been brought to fruition with this newest development.

Cargo contained, water derailed by hopper cars hauling products cross-country 48
Fabrication techniques and specifications of materials used in production of all-welded super-jumbo hopper cars are described. Over 500 lb of electrodes and wire were used for each car.



Resistance welding of aluminum alloys 50
J. F. Deffenbaugh discusses the basic principles and the variables in selection and application of resistance machines for welding aluminum alloys through a comparison with mild steel welding techniques.

An introduction to non-destructive testing of welds 54
This field of testing is growing rapidly. **H. B. Norris** reports on the main processes and shows how combinations of these six groups are applied when testing turbine generator components.

Good mechanical properties can be obtained when Tig welding titanium 58
Lacking a large titanium-consuming aircraft industry, author **Helmut van Kann** details how other German industries studied, tested and approved Tig welding techniques for joining titanium.

Consider residual stresses when welding 66
Tensions created during welding cannot be ignored, and **R. E. Holt** gives his explanation of the reasons why.

Also in this issue:

Spiral-welded tubing offers strength, efficiency and economy 53
With the AWS in Chicago 56
Giant derrick parts are welded on a king-size jig 62
Modern metals displayed at British welding show 69
Boating is no pleasure in Bolivian waters 70
Welding plus light metals equals portable tractor for combat area construction 76
High automation is the key to speed, economy and efficiency 78
Most job shops unaffected by recession 82
New regulators cut waste of inert-gases 84

Regular **WE** features . . .

News 7
Your WeldWorld at press time 13
Letters 34
Between passes 39
Editorial: *Sixty years of service* 43
Welding Clinic: *How to weld stainless steel tubing* 72
On the job 74
Data Sheet: *Analyzing metal cleaning costs* 81
New products 85
People 98
Book reviews 100
30 years ago 101
Free literature 102
The Welding Shopper 103
Advertisers in this issue 104
Literature offered in ads 104
Welding Info-Aids 105

Published monthly, with an additional directory number in June, by Welding Engineer Publications, Inc. Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of March 3, 1879. Printed in U.S.A.
Tear sheets of many Welding Engineer articles are available free of charge up to 3 months following date of publication.

©1959 by Welding Engineer Publications, Inc.

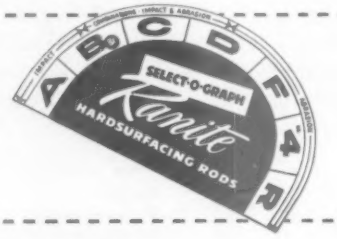
Ranite–The ORIGINAL Metallic-Coated Hardsurfacing Rod

is still easiest to select, easiest to use and offers the most advantages!

NO OTHER HARDSURFACING MATERIAL OFFERS ALL THESE ADVANTAGES:

- Equally good operation with AC and DC machines
- Readily applied in all positions
- Quiet, stable arc
- No Splatter loss
- No slag to remove
- Clear welding vision
- Economical because there is minimum of flux, maximum of material to enter weld
- Arc easily re-struck, if broken for any reason
- Very little tendency for deposit to check because rods alloyed with proper coefficient of expansion
- Firm bonding of deposit to base metal
- Ranite-coated surfaces can be torch-cut when necessary, thus reducing repair costs
- Rapid deposition rate cuts welding time
- High recovery rate assures more *deposited* metal per pound
- Broad latitude of Ranite rods gives weldors ample leeway in selection and use
- Correct rod selection is simple and easy–the big majority of all jobs are handled by just five Ranite rods–A, BX, C, D and No. 4

GET FREE Ranite Select-O-Graph Guide—shirt pocket size—shows best rod to meet any wear condition. Ask your Ranite distributor or write direct.



Originators and pioneers of metallic-coated rods—since 1938

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

RANKIN MANUFACTURING CO.
616 So. Marengo Ave., P. O. Box 631
Alhambra, Calif.

Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

•

WELDING ENGINEER PUBLICATIONS, INC.
P.O. Box 28
Morton Grove, Ill.
Telephones:
ORchard 4-5130, IRving 8-3355

•

TED B. JEFFERSON
Editor and Publisher

•

FELIX T. TANCULA
Executive Editor

•

G. J. CANNIZZO
Associate Editor

•

KEN RHODIE, *Assistant Editor*

•

FRED BISHOP, *News Editor*

•

ROBERT M. DAVIS, *Production*

•

DON T. JEFFERSON, *Promotion Manager*
LLOYD GOSSMAN, *Circulation*
JIM BREWSTER, *Circulation Promotion*

•

WARREN WARE
Western District Manager
P.O. Box 28
Morton Grove, Ill.
Telephones:
ORchard 4-5130, IRving 8-3355

•

HERMAN PHELPS
Eastern District Vice President
P.O. Box 128, White Plains, N. Y.
Telephone: WHite Plains 9-3876

•

MEMBER
American Welding Society
International Acetylene Association
Compressed Gas Association
National Welding Supply Association
Audit Bureau of Circulations

•

Single copies 50 cents. Subscription rates: United States and possessions $3 per year; $5 for two years; $7 for three years. Canada $5 per year; $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

ON THE NOSE!

Norton "44-B11" wheels make the ideal abrasive-and-bond combination for heavy weld grinding

Smoothing Welds on a diesel locomotive's nose section, a Norton flaring cup wheel of 44 ALUNDUM* abrasive-B11 resinoid bonded, is easier on the operator, adds to the diesel's looks, cuts maintenance costs . . . a "Touch of Gold" performance!

Built-In Reinforcement is a feature of Norton cup wheels in standard size 6/4 x ¾ x 2". The new steel cup bushing, molded firmly into the wheel back, provides added safety.

W-1913

Better grinding for less money is the consistent record of Norton wheels combining 44 ALUNDUM abrasive and the B11 resinoid bond — the highest scoring team in the field of weld grinding.

"44" is tougher and harder than other non-premium priced abrasives, cuts faster and cooler and lasts longer.

The B11 resinoid bond results in more uniform, better balanced wheels. They "hug that work" closer with less vibration and bounce . . . are precision duplicated in half-grade increments across the entire hardness scale.

Get more facts on how this outstanding wheel combination can benefit your weld grinding. See your Norton Distributor for complete details and prompt service. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEAR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

VICTOR CUTTING TORCHES AND TIPS

. . . because he can always count on Victor to fill his needs. Shown here is one of Victor's **new** LPCG series . . . available for both hand and machine cutting with **new** natural and propane preheat gas cutting tips.

Remember, Victor torches perform best when you use genuine Victor cutting tips. Order from your Victor dealer now and cut your costs with Victor cutting tips.

VICTOR for welding

48

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

844 Folsom St., San Francisco 7 • 3821 Santa Fe Avenue, Los Angeles 58
1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

Hollis

Gunzelman

Machinery manufacturers organize trade association

The Automatic Welding Machinery Association, organized recently at Chicago, is composed of 23 manufacturers of automatic welding machinery *(WE, May, page 15)*. Group headquarters has been established in The 1010 Euclid Building, Cleveland.

First president of the association is E. W. Hollis, general sales manager of the Lewis Welding & Engineering Corp., Bedford, O. Willard Gunzelman, general manager, World Electric Co., Cleveland, was elected vice president.

Among the new association's objectives is the promotion of greater and wider uses and markets for automatic welding machinery.

The other members of the executive committee are: Paul Galton, Worthington Corp., Plainfield, N. J.; John Berryman, Special Products Div., Air Reduction Co., Union, N. J.; John Berkeley, Berkeley-Davis Inc., Danville, Ill.; E. J. St. Eve, Pandjiris Weldment Co., St. Louis; and J. H. Cooper, Taylor-Winfield Corp., Warren, O.

NCG opens west coast liquid oxygen plant

A plant that can produce more than 35 tons of liquid oxygen, nitrogen, and argon daily, has been placed on stream by National Cylinder Gas Div. of Chemetron Corp. at Los Angeles.

The plant is dominated by a 56-ft-high fractionating column. It is located at 11705 S. Alameda St., adjacent to NCG facilities now producing oxygen, nitrogen, hydrogen, and acetylene in gaseous form.

Nuclear organizations plan joint meetings

The American Nuclear Society and the Atomic Industrial Forum have announced plans to conduct a series of coordinated meetings. This will include a fall meeting in Washington, D. C.; and meetings in 1960 at San Francisco, and in 1961 at New York City.

Corrosion test findings available from AWS

After an exposure period of three years, the American Welding Society has now made available the results of a corrosion test evaluation program for metallized coatings.

Over 4,300 specimens were exposed at eight test sites. Major objectives are: to determine life of coating in each environment, the effect of various methods of preparation of the steel, and the increase in life of zinc and aluminum coatings with seal coatings added. Panels were exposed to rural, industrial, salt-air and salt-spray environments. They were to be examined at 3, 6, 9, and 12-year intervals.

Machine design contest closing date is July 20

Persons planning to enter the Machine Design Award Program sponsored by the James F. Lincoln Arc Welding Foundation, Cleveland, must mail their papers on or before July 20.

Papers are required to describe the use and advantages of arc welding in the design and construction of a machine or machine component. A total of 54 awards will be made, amounting to $50,000. First place award is $10,000; second place, $7,500.

A 24-page brochure published by the Foundation covers rules of entry.

Sign announces 50th state

STATEHOOD for Hawaii is now proclaimed by sign on "pineapple" tank in Honolulu built by Chicago Bridge & Iron Co. for Hawaiian Pineapple Co. Same "pineapple" which is a welded water reservoir first appeared in *WE*, November, 1956, p. 43.

Nuclear merchant vessel to be launched July 21

Mrs. Dwight D. Eisenhower will christen the world's first nuclear powered merchant vessel, Nuclear Ship Savannah, July 21, at the New York Shipbuilding Corp., Camden, N. J. President Eisenhower started the legislation for the all-welded ship in October, 1956.

He said, "This new vessel will be a floating laboratory, providing indispensable information for the further application of atomic energy in the field of ocean transportation."

The N. S. Savannah is a combination passenger-cargo vessel, 595½ ft long, with a 78 ft beam. It will be capable of carrying more than 60 passengers, a crew of about 100 and 9,500 tons of cargo at a speed of 20¼ knots.

The reactor is designed to operate for over three years on its initial fuel loading. It is of the pressurized water type and is being built under an Atomic Energy Commission contract by Babcock & Wilcox, Beaver Falls, Pa. Total cost of the ship and reactor will be about $40,000,000.

Canadian operation for Crucible Steel Co.

Crucible Steel Co. of America, Pittsburgh, has arranged to set up a Canadian company to acquire the steel making facilities of Sorel Industries Ltd., Sorel, Quebec.

The new company, Crucible says, is expected to produce high speed tools, stainless and other alloy steel products for the Canadian market and for export.

Standard samples for gases-in-metals

Now available from the National Bureau of Standards, Washington, D. C., is a new type of standard sample comprised of eight bars of ferrous materials, whose oxygen and nitrogen content have been precisely determined.

These reference materials, about 3-in. long and 1 in. in diameter, are necessary for the calibration of chemical analytical equipment used to measure the gas content of various kinds of commercial steels.

In providing these reference materials, the Bureau has inaugurated a program of standard samples for gases-in-metals, covering a variety of metallurgical products.

Porous metal

SCIENTIST Robert H. Read of Armour Research Foundation of Illinois Institute of Technology, Chicago, pours water through a rigid, yet uniformly porous piece of fiber metal. In new process, fiber metallurgy, thin fibers of metal are interlocked like a felt cloth and bonded together with heat.

Arcair institutes school for distributors

A special training program conducted for Arcair Co., Lancaster, O., distributor salesmen graduated its first class recently.

The three-day course is designed to qualify salesmen to sell to any industry and puts emphasis on using all company torches. Some emphasis is placed on qualifying salesmen to sell the automatic unit, to develop their ability to make recommendations for customer use of the equipment.

Welding conference to be held in Berlin

"Welding technology for power supply," will be the general subject discussed at the Great Welding Conference to be held June 23 to 26 in Berlin. The conference is being sponsored by Deutscher Verband Fur Schweisstechnik of Dusseldorf.

General specifications for federal bids formulated

General specifications for the U. S. Government to use when issuing bids for welding material have been decided upon the Arc Welding section of the National Electrical Manufacturers Association was told at its recent Pittsburgh meeting.

In a committee report, the Federal and Military Specifications committee, working in conjunction with a similar U. S. Navy committee, told the assemblage that the agreement reached will benefit the government as well as its welding industry suppliers.

Also at the meeting, the Reynolds Metals Co. was presented as a new member of the Arc Welding section.

Pioneer oil men honored at exposition

Special awards were given during the International Petroleum Exposition at Tulsa, to eight "Old Timers" selected from many nominations received from throughout the oil industry. *(See "One hundred years," WE, May, p. 27.)*

William L. Connelly, Tulsa, who drilled his first well 64 years ago, was named "Pioneer of Pioneers." Seven other men, each representing a division of the industry, shared the spotlight with Connelly.

New AWS chapter is activated at San Diego

Chairman of the recently activated San Diego American Welding Society section is Robert L. Hawkins, process engineer for Convair, in the Astronautics Div. of General Dynamics Corp. The new chapter has a charter membership of 89.

Hawkins states that concentration of aircraft, missile and electronic industries in the San Diego area, with new technical procedures required by these industries, makes such a group essential.

One purpose of the new group will be to stimulate interest in the science of welding among younger people, and a speakers' bureau and films will be provided for this purpose.

COMING EVENTS

JUNE 4-5: NEMA Arc Welding Section Quarterly Meeting, Hot Springs, Va.
JUNE 15-17: Meeting of Compressed Gas Association, Seaview Country Club, Absecon, N. J.
JUNE 15-26: Ohio State University Summer Course on Fundamentals of Welding Engineering. Sponsored by Dept. of Welding Engineering, Columbus.
SEPT. 24-25: NWSA Central Zone Meeting, Detroit.
SEPT. 28-29: NWSA Eastern Zone Meeting, New York City.
SEPT. 28-OCT. 1: National Fall Meeting of the AWS, Detroit.
OCT. 19-20: NWSA West Central Zone Meeting, Minneapolis.
OCT. 22-23: NWSA Western Zone Meeting, Las Vegas.
NOV. 2-6: 41st National Metal Exposition and Congress, International Amphitheatre, Chicago.
NOV. 30-DEC. 1: NWSA Southeastern Zone Meeting, Atlanta.
DEC. 3-4: NWSA Southwestern Zone Meeting, Fort Worth.

Cardox opens new Wisconsin warehouse

A new warehouse for the storage and distribution of carbon dioxide has been opened at 106 South First St., Madison, by the Cardox Div. of Chemetron Corp., Chicago. Howard C. Symmes, sales representative for the state of Wisconsin, is supervising the warehouse.

Aluminum concrete mixers being mass produced

Aluminum transit concrete mixers, fabricated with welding as the prime means of joining, were still in the field testing stage a little over a year ago. *(See "Aluminum diet reduces concrete mixer," WE, p. 60, April, 1958.)*

Now they are coming off the production line at Construction Machinery Co., Waterloo, Iowa. These alu-

(Continued on page 94)

THESE aluminum concrete mixers, among first built in this country are now in operation at Central Pre-Mix Concrete Co., Spokane. They were developed jointly by Construction Machinery Co., Waterloo, and Kaiser Aluminum & Chemical Corp., Oakland, Cal., and built by CMC. Mixers are 7-yard CMC Transcretes mounted on International truck chassis.

24 Pages *of interesting data on cylinder manifolds* • • •

• • •

This 24 page catalog (our Form 14) offers a beautifully illustrated description of the COMPOUND PRESSURE cylinder manifold for industrial and medical cylinder gases. There are no solder joints, and the entire cylinder manifold may be assembled or disassembled with the use of two open-end wrenches. All assembly parts can be carried in stock and the parts are so designed that they permit prompt assembly of cylinder manifolds of every useful capacity; "wall type, stand type with center sections for one or more regulators, for manual or automatic changeover." The COMPOUND PRESSURE cylinder manifold is the sturdiest, the safest and the most attractive one your money can buy, and its price is very little more than that of ordinary manifolds. If you are interested in cylinder manifolds,

write us for catalog form 14

551 DEPT.

NATIONAL welding equipment company... 218 fremont street san francisco 5 california

Lincoln

WELDYNAMICS

Oil well pump chain housing is positioned for flat welding with Jetweld. Welding speed is doubled.

OIL FIELD PUMPING UNITS NOW WELDED TWICE AS FAST

Doubling welding shop production without increasing their investment in labor or machines was accomplished by the Parkersburg Rig and Reel Company at Coffeyville, Kansas.

This firm manufactures oil field pumping units. The complete structure of these units is welded and varies in size depending upon the requirements of the well on which they are to work. Bases are fabricated from as small as 8" 17 lb. beams to as large as 14" 68 lb. beams. One exceptionally large unit used a 36" 210 lb. member for the walking beam.

Under the supervision of Jess Kern, Plant Manager and Sammy Doss, Welding Foreman, tests were conducted in the Parkersburg shop in an effort to increase welding efficiency.

A Lincoln welding engineer, Robert Clipsham, surveyed the welding operation. He studied the procedures used and conducted tests with various electrodes and equipment.

The survey indicated that with minor positioning changes almost every weld could be made with a faster, easier-operating iron-powder electrode.

Parkersburg is now using Jetweld 1 electrodes almost exclusively. Mr. Doss says, "Jetweld is twice as fast as the conventional electrodes we were using. It gives us better looking welds, mileage per rod is greater, and weld cleaning is much easier and faster."

Completed chain housing mounted on base fabricated from I beams.

Sammy Doss, Welding Foreman at Parkersburg Rig and Reel has switched to Jetweld almost exclusively.

For help with welding procedures and cost reduction ideas call your Lincoln welding engineer today.

NEW WELDER TAILORED TO YOUR NEEDS

The new Lincoln Idealarc "TM" welder has been designed to meet the needs of any shop.

The key to the "TM" model's versatility is a wide range of options that expand the uses for the machine.

This new Idealarc is available as a straight AC machine or AC/DC machine and in 300, 400, and 650 ampere sizes.

Many other options give the owner a choice of the finest welder at lowest cost or a deluxe model that is the last word in convenience and utility.

For a complete description of the Idealarc "TM" welders, write for Lincoln Bulletin 4607.1.

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

HOW FLORI PIPE CONTROLS QUALITY AND COSTS . . . MEETS DELIVERY DEADLINES

Keeping quality up, costs down and still maintaining delivery of prefabricated pipe sections is a tough job for anyone. But even on such vast piping jobs as Tidewater Oil Company's Delaware refinery it is all in a day's work to the Flori Pipe Company of St. Louis, Missouri. Flori is one of the nation's leading fabricators of high pressure pipe for the petroleum and petro-chemical industry.

Flori's Welding Engineer is Ken Notvest. He is responsible not only for welding methods and procedures, but also for maintaining the high degree of welding quality required on the special alloy pipe work in which Flori specializes.

Better quality, lower cost when Lincoln mild steel wire and alloy fluxes are used on high pressure pipe.

Jetweld LH-70 gives 99% X-ray acceptance.

Mr. Notvest has developed some excellent procedures for manual welds. He uses Fleetweld 5-P, a Lincoln E-6010 electrode, for root beads in carbon steel pipe and follows with Jetweld LH-70, a low hydrogen E-7018, for cover passes. This gives them 99% X-ray acceptance on open gap welds without backing rings.

After testing many different electrodes for this application Mr. Notvest believes Jetweld LH-70 to be superior for deposition rate, appearance, out-of-position welding, and as-welded low temperature impact strength.

Flori also has many automatic submerged arc welding applications in their pipe fabricating plant. They once welded alloy pipe with alloy wire and neutral flux. However, as a result of a survey conducted in the plant by John Lucas, a Lincoln welding engineer, they have found that Lincoln alloy fluxes (mixed especially for them), and mild steel wire cut material costs by two-thirds—cut welding time in half and make better welds.

Mr. Notvest claimed, "When we invited the Lincoln man to survey our operations we had no idea that the result would make such substantial savings."

For cost reduction ideas and help with procedures, call your Lincoln welding engineer today.

Ken Notvest, Flori's Welding Engineer, examines a weld from the inside with the "Bore Scope" he designed and built.

The LINCOLN ELECTRIC CO.

Dept. 1757 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

1. After beveling both copper and type 347 stainless steel to provide an 80° included angle, ⅜-in copper specimen is pre-heated to about 1000°F.

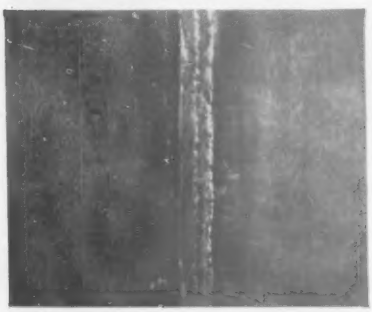
2. Using 5/32-in, "141" Nickel Electrode, weldor overlays copper with overlapping beads. The two layer overlay is run well over the edges of the bevel.

3. After 3/16-in nickel overlay has been applied to pre-heated copper, 40° bevel is restored. Straightedge is used to assure bevel is even and true.

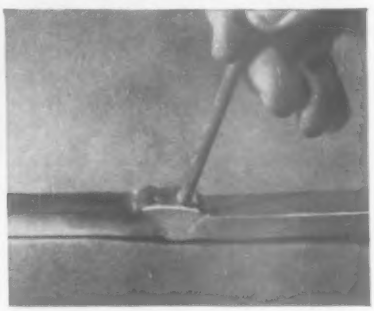
4. Type 347 stainless steel, left, is positioned with copper to allow root spacing of ⅛-in. Both ends of the copper to stainless joint are then tacked.

5. Root pass is run in, followed by beads that alternate between sides and middle of root. Current is now 200 amps. "141" Electrode is 3/16-in diameter.

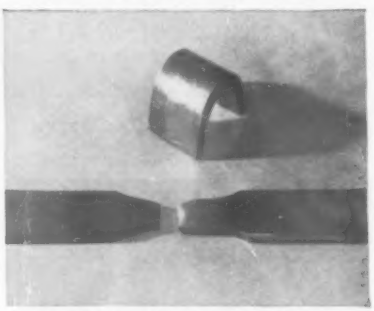
6. Chipping out slag and wirebrushing is important to quality of final weld properties. Weld should not extend beyond the nickel overlay on copper.



7. Closeup of the final weld shows even contour, good fusion and good penetration. Copper is on the left, type 347 stainless steel is on the right.



8. Cross section of weld, after etching and macro examination, shows no porosity, cracking, fissures, slag entrapment. Weld is then tested further.



9. Longitudinal bend test proved no failure. Copper to stainless weld is strong, ductile, sound. Short gauge tensile test broke in copper at 33,200 psi.

How to weld Copper to Stainless Steel

Of all the so-called "problem joints," welding copper to stainless steel is considered one of the most difficult. Many weldors say it's impossible. But it can be done . . . and done well with Inco's "141"* Nickel Electrodes. Or with Inco's "61"* Filler Wire if you're set up for MIG or TIG welding.

Above, we have outlined a recommended procedure for welding copper to stainless steel. Your local distributor of Inco Welding Products, listed under "Nickel" in the classified, can give you more information, as well as the sizes and prices of "141" Nickel Electrodes and "61" Nickel Filler Wire.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street — New York 5, N. Y.

*Registered trademark

INCO WELDING PRODUCTS

electrodes • wires • fluxes

WELDING ENGINEER

Your June, 1959 Weld World

As WE went to press, these were the industry's latest developments:

. . Preliminary figures show that the welding industry's total sales for 1958 were under $900 million. Complete statistics, compiled by WE's Research Dept., will be published in the Mid-June Fact File issue.

. . From first quarter reports received, it is evident the welding industry is making fine comeback from last year's dip in sales. Five major manufacturers have released statements showing sales and profits up over last year's first quarter.

. . But don't look for any boom in general economy. Best guess for another record year is 1960 or 1961.

. . Arcos Corp., Philadelphia, has obtained exclusive distribution rights in United States for Vertomatic welders. These machines for electroslag welding were exhibited at the AWS show in Chicago by Amalgamated Industrial Corp., Philadelphia, an Arcos affiliate.

. . A. C. (Andy) Axtell, president of Essex Welding Equipment Co., Inc., Newark, was elected president of the National Welding Supply Association last month in San Francisco. V. B. Anderson, of V. B. Anderson Co., Santa Ana, Calif., was chosen executive vice president, a new post.

. . Board of directors of National Welding Supply Association voted against combining national convention with that of American Welding Society. Reports from San Francisco, where NWSA meeting was held last month, indicate there is great deal of sentiment among members for this combined affair, but not among top brass.

. . Ike's statement regarding steel strike may have some bearing on outcome of bargaining talks. Neither side would like to have the government step in. One speculation (not ours): that the union chiefs might offer to work beyond deadline without contract during negotiations, thus avert strike.

. . Air Products, Inc., Allentown, Pa., has purchased Compressed Gases of Ohio, Inc., Cleveland.

. . General Cable Corp., New York City, has acquired Indiana Steel & Wire Co., Muncie, Ind.

. . Your leather protective clothing soon will cost more. Prices for leather have risen drastically since first of year and are now up about 170% over what they were a year ago.

. . Mallory-Sharon Metals Co., which presently has three owners (P. R. Mallory & Co., Sharon Steel Corp., and National Distillers & Chemical Corp.) may soon have a fourth--Bridgeport Brass Co.

Liner Markings End Mix-Ups—Save You Money!

• Here is a new, exclusive PAGE development which will benefit you. Each coil of PAGE automatic welding wire now has the grade stamped on the inside of the liner, insuring positive, instant identification. And—on #2 coils, in addition to the stamped grade number, liners are color-coded; the color of the stripe on the liner indicates the grade, making identification double-quick and foolproof.

What does this mean to you? No more scrapping of partly-used coils because tags have been lost. No more danger of using the wrong analysis when coils are mixed in storage. Positive identification ends waste and confusion.

This means real savings to you—and these new PAGE features are yours at no increase in price.

Let PAGE Help Solve Your Welding Problems

These Folders can help you

Write for:

Folder DH-402-0 Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

Positive identification is just one of the advantages that PAGE has to offer. When you bring your welding problems to PAGE, you get the benefit of over half a century of wire-drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses—33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

PAGE wire packaging is designed to give you the utmost in convenient storage and handling, whether you require a 1# spool or a 1200# payoffpallet. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located PAGE warehouses.

You will find it is "good business" to bring your problems to PAGE.

ACCO

PAGE WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

PAGE—THE SOURCE FOR ANSWERS TO WELDING PROBLEMS

Improve Service and Efficiency in Liquid Oxygen Transportation

This is a Cambridge Liqua-Guard Semi-Trailer Model 4100L used for transporting liquid oxygen. It uses a Cambridge vacuum jacketed aluminum vessel and features light weight and high payload. It comes complete with Cambridge medium pressure pump.

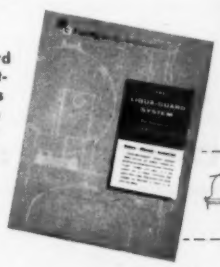
...with Cambridge Liqua-Guard Products

Cambridge "liquid logistics" offers today's most modern concept for transporting and distributing atmospheric gases.

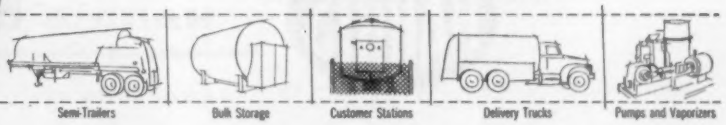
- Far greater product volume vs. weight ratios — one semi-trailer transports equivalent of 18 truckloads carrying 100 standard cylinders each!
- Minimizes personnel and physical damage hazards.
- Reduces labor and releases storage and yard space.
- Less frequent delivery, ample gas supply always available.

Many gas manufacturers are now taking advantage of this modern "liquid concept" with Cambridge Liqua-Guard Semi-Trailers and Delivery Trucks. They are part of the complete Liqua-Guard System which gives atmospheric gas users improved efficiency and service by storing, transporting and distributing in liquid form.

The Cambridge Liqua-Guard System for Liquefied Atmospheric Gases features a complete line of vacuum jacketed vessels, vaporizers and associated equipment. Send for Bulletin CS19 today.



CAMBRIDGE COMPANY
A DIVISION OF CARRIER CORPORATION
4 Industrial Ave., Lowell, Mass.



CC9-3

HARRIS

universal pressure welding torch No. 43 and the No. 49 cutting attachment will

outstanding features:

1. All welding assemblies and cutting attachments operate on *less than 1 pound* of Acetylene, permitting complete withdrawal of all the gas.
2. Safer . . . virtually impossible to back oxygen into acetylene line.
3. Exceptional Flame Stability, due to unique mixing principal.

MAKE US PROVE THESE STATEMENTS

Call your nearest Harris Distributor for a Demonstration—or write to us.

HARRIS

HARRIS CALORIFIC CO.

5501 CASS AVE. • CLEVELAND 2, OHIO

a frank report

by **A.O.Smith**

on new techniques and new equipment for the most advanced automatic and semi-automatic CO_2-shielded welding processes.

who's who in CO_2

. . . and from **A.O.Smith . . . .**

C-OMANUAL

C-OMATIC

C-OMANUAL BUTTON WEL

YES! Gun-trigger welding speed

Operator works with a visible arc, welding joint always visible, no excuse for misplaced welds. The CO_2 "gun" or "head" automatically compensates for arc length, puts down metal at rates up to 30 lbs./hr. Work is never interrupted by a need to chip slag or clean flux. Just pull the trigger (or push the button) and you're off!

YES! New production flexibility

A. O. Smith CO_2 processes can be used on a wide range of gages, from approximately 0.075-inch to 1½-inch plate, on fillet, lap, butt welds, or for steel casting repair. Simplicity of operation coupled with high weld quality leads to many new applications. Operator enthusiasm for the process keeps production jobs rolling.

advantages with CO_2 ?

YES! Substantial cost savings

Process efficiency depends, of course, on proper application. When the application is right, the exceptional deposit rates, the low cost of CO_2 compared with that of other shielding gases, and the low gas consumption rate—add up to substantial savings.

YES! Strength and ductility

Use of CO_2 (carbon dioxide gas) as a shielding envelope produces welds that are strong and ductile. Extensive tests and field applications prove that the CO_2 processes are here to stay — for low-cost, high-speed welding of mild and medium carbon steel.

CO_2 *welding processes!*

..... **A semi-automatic hand-gun process.**

Consists of a 600-amp Constant-Potential power source; an integrated wire-drive unit; a lightweight, perfectly balanced hand gun.

..... **A fully automatic process.**

For high production mild steel welding. Consists of exceptionally efficient and dependable 600-amp CP power source; control panel; fully automatic welding head.

DER **A semi-automatic hand-gun process.**

Consists of the basic C-OMANUAL equipment, with the addition of a cycle timer and specially designed nozzle fittings. Produces button welds of all types with speed and quality.

Let's look at this A.O.Smith C-O manual !

what?

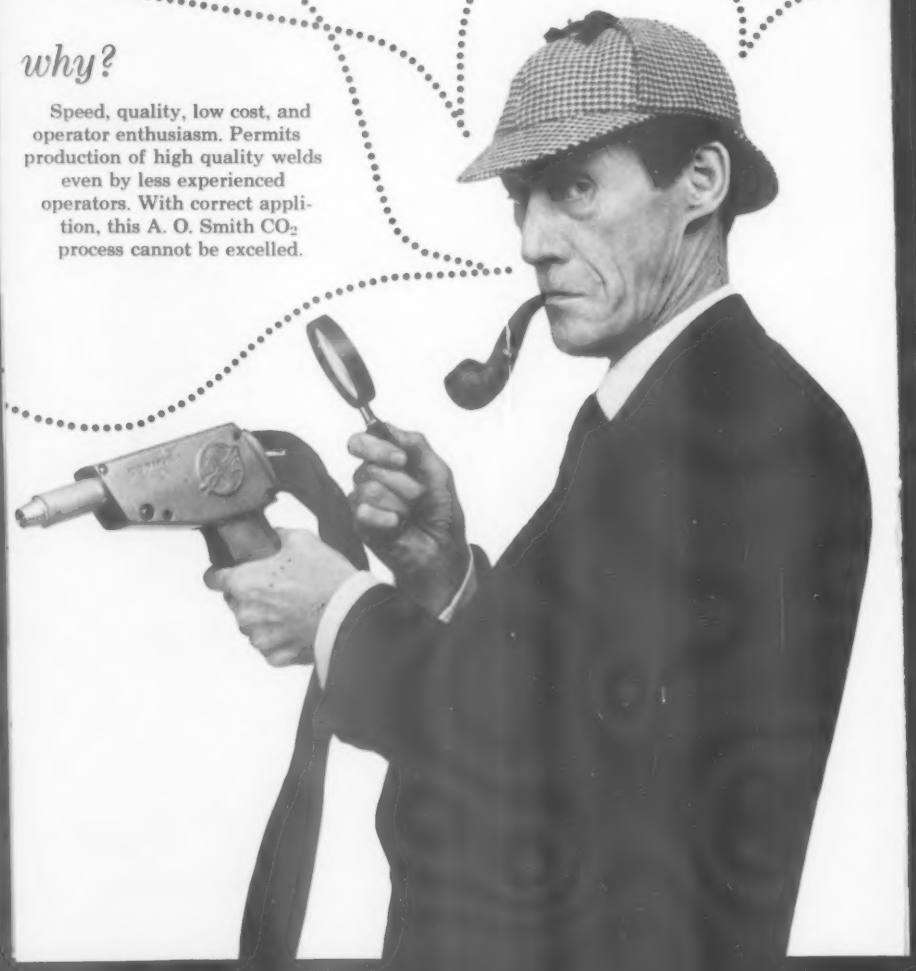
a semi-automatic hand-gun welding process that uses CO_2 as a shielding envelope with specially developed CO_2 wires . . fast, flexible, money-saving.

how?

The operator sets his voltage and wire speed, positions his gun, and pulls the gun trigger. That's all there is to it. Visible arc assures weld quality.

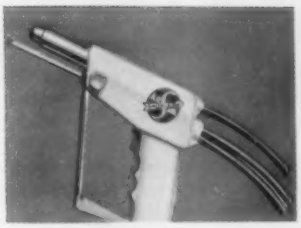
why?

Speed, quality, low cost, and operator enthusiasm. Permits production of high quality welds even by less experienced operators. With correct appli-tion, this A. O. Smith CO_2 process cannot be excelled.



GUN

Featherweight, pistol-grip hand gun (includes hose and cable assembly) — as easy to use as pointing a finger. Water-cooled, without "O" rings, it eliminates leakage troubles. All connections are fully protected. Changing wire sizes is fast and simple.



WIRE DRIVE UNIT

Can be mounted on top of power source. Consists of mechanically governed wire feed motor, gear-motor for remote wire feed speed change, dual drive wire feed rolls, post-purge gas and water timer and solenoids, safety water pressure switch, control relays.

POWER

A. O. Smith 600 amp continuous duty CP welder. Slope Control provides tap switch adjustment of output characteristics from very flat (.6 volts per 100 amperes droop) to very drooping (8 volts per 100 amperes) slope. Widest voltage range, 0 to 45.4 volts at rated load. Built-in 2 KVA—115-230 volt control transformer provides power for accessories. Fixed 180 amp connection for stick electrode tacking.

WIRE LOADING

As easy as changing a record on your record player. A. O. Smith automatic welding wire designed specifically for use with CO_2, takes only a few minutes to change. Keeps the job rolling with minimum downtime. Wire is available in reels, coils, Pay-off Paks.

THE "PACKAGE"

The complete package consists of the 600 amp Constant Potential power source, wire drive unit and hand gun, connected to the wire drive unit by gas and water hose, water cooled welding power cable, wire feed conduit cable and remote control switch. Also included are wire drive swivel mount and power cable.

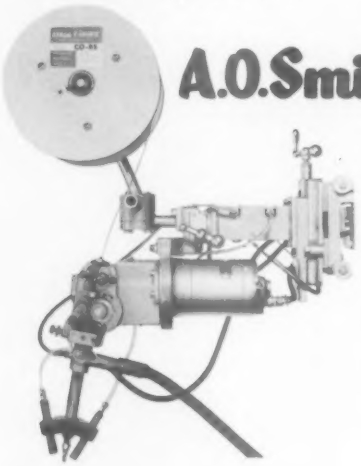
Optional equipment includes: Cooling water recirculator, CO_2 pressure regulator and flowmeter, and Stellarweld reactor which provides a variety of arc characteristics for various applications.

C-OMATIC . . . is the original fully automatic CO_2 welding process, offering all of the many advantages of CO_2 welding plus a history of automated performance unmatched in industry. Many units installed and operating every day are your assurance of satisfaction.

Primary C-OMATIC components consist of an A.O. Smith 600 ampere Constant Potential power source; compact control panel; and rugged automatic head. Secondary components include all necessary gas, water and power cables; a choice of specially designed CO_2 welding wires in any diameter and package size; all necessary fittings, gages, etc.

"*Just a voltage adjustment . . .* on the A. O. Smith 600 ampere Constant Potential power source. Two knobs on the front of the unit provide "coarse" and "fine" voltage to fractions of a volt. Slope Control provides additional voltage regulation to fit any job requirement."

A.O.Smith C-Omatic..



AUTOMATIC HEAD feeds weld wire ($\frac{1}{32}$-in. to $\frac{5}{32}$-in. sizes) at speeds to match job requirements. Simple adjustment for variations in the wire's lead and trail positions.

CONTROL PANEL is a portable pushbutton station for automatic operation of the welding head. Has vernier wire adjustment. Mounts easily anywhere in view of operator. Controls, stop, start, inch-up, inch-down, amperage and wire-feed speed.

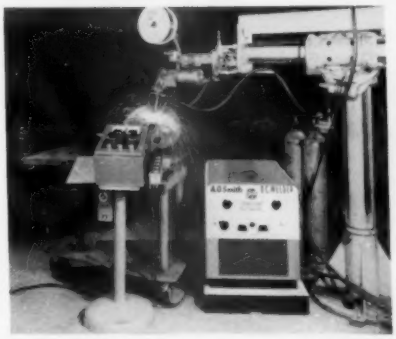
Two heads are better than one!

"*Just set one knob . . .*
on the compact control panel. A twist of the wrist takes care of both amperage and wire feed speed. Heavy duty start-stop buttons, a variable crater fill control, voltmeter and ammeter dials make this the simplest and most foolproof unit in the industry."

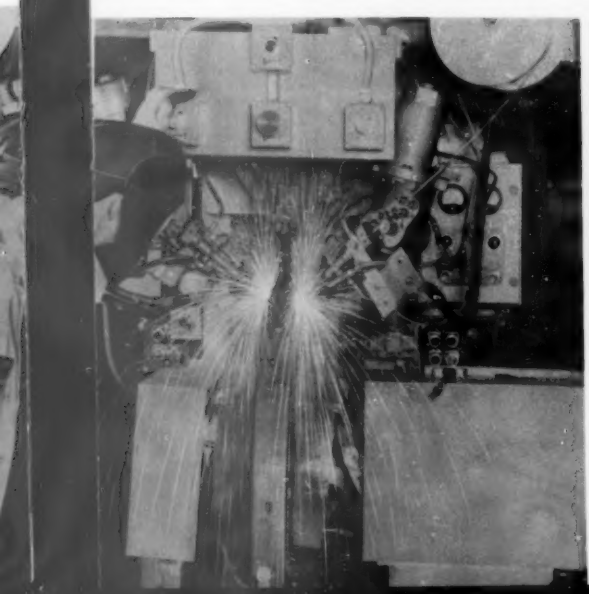
"*That's all there is to it!*
Push a button and go. Automatic head was designed for high speed production where downtime is costly. Connections are all plainly marked and keyed. Head has infinite number of adjustments. And reel changing takes only a few seconds."

full automation for CO_2 welding

POWER SOURCE is full 600-amp CP welder with the widest voltage range available — 0 to 45.4 volts. Instant striking, no sticking. Slope Control for infinite adjustment.



COMPLETE "PACKAGE" for the A. O. Smith C-OMATIC process includes CP power source, remote control panel, automatic welding head, nozzle, three position mount and all necessary hoses, cables and fittings.



TWO C-OMATIC HEADS MOUNTED FOR SIMULTANEOUS WELDING

Automotive front cross bar longitudinal weld, with the heads mounted in the 3 and 9 o'clock positions. The irregular shaped piece is rotated between the heads. At the high speed of travel (185 ipm vs. 50 ipm hand arc), the wire alignment to the seam is critical; therefore electronic tracers have been incorporated into the fixture to assure proper alignment. Tacking was eliminated.

See following pages for
*Application Charts
*Physical Data

A.O.Smith

C-O manual

C-O matic

APPLICATION DATA CHARTS

LAP JOINTS

Stock Thickness A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
1/16"	3/64"	260/300	28-30	100-120	10-15° D.H.	12-19	0-10° trail
	1/16"	390/420	24-31	140-160	10-15° D.H.	12.5-17	0-10° trail
	3/64"	240/300	26-30	110-130	Flat	11-19	0- 5° lead
1/8"	5/64"	580/600	30-32	120-150	10-15° D.H.	21-28	0-10° trail
	1/16"	450/520	29-32	150-160	10-15° D.H.	18-24	0-10° trail
	1/16"	380/420	26-30	70-90	Flat	12-17	0- 5° lead
3/16"	1/16"	420/480	29-32	40-60	0-5° D.H.	17-20	0-10° trail
	5/64"	480/540	29-32	50-70	0-5° D.H.	17-21	0-10° trail

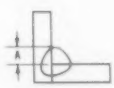
A. O. Smith automatic wire No. CO-86 was used in all the above instances.

HORIZONTAL LAP JOINTS

Stock Thickness A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
1/8"	1/16"	440/480	27-32	80-120	10-15° D.H.	16-20.5	0 to 8° trail
	5/64"	480/500	28-30	130-160	10-15° D.H.	17-21	0 to 8° trail
3/16"	1/16"	420/480	27-32	60-100	10-15° D.H.	17-20	0 to 8° trail
	5/64"	540/590	28-32	90-140	10-15° D.H.	21-27	0 to 8° trail

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

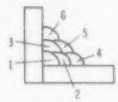
HORIZONTAL FILLETS



Fillet Size A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
1/8"	1/16"	340-380	32-34	35-45	Flat	10-14	Nozzle at 45°
1/4"	1/16"	350/400	32-34	30-40	Flat	12-16	Nozzle at 45°
5/16"	1/16"	360/420	32-36	25-35	Flat	13-17	Nozzle at 45°
3/8"	1/16"	360/420	34-38	15-20	Flat	13-17	Nozzle at 45°

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

HORIZONTAL FILLETS MULTI-PASS



Layer	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
1	1/16"	360/420	32-35	20-25	Flat	13-17	0-5° trail
2	1/16"	370/430	33-37	25-30	Flat	13-17	0-5° trail
3 etc.	1/16"	370/430	33-37	25-30	Flat	13-17	0-5° trail

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

POSITIONED FILLETS

Fillet Size A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
1/4"	1/16"	420/440	35-38	25-30	Flat	14-19	0-10° trail
3/8"	1/16"	460/480	38-42	20-30	Flat	15-22	0-10° trail
1/2"	1/16"	500/520	38-42	15-18	Flat	18.5-25	0-10° trail

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

Take a close look at some typical CO_2 applications

POSITIONED MULTI-PASS FILLETS

Layer	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr
1	1/16"	500/520	40-42	15-18	Flat	18.5-25
2	1/16"	500/520	40-42	10-15	Flat	20-26
3 & 4	1/16"	500/520	40-42	15-20	Flat	18.5-25

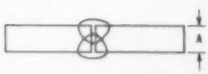
A. O. Smith automatic wire No. CO-86 was used in all the above instances.

BUTT WELDS (Steel Back-up)

Stock Thickness A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Gap B	Dep. Rate Lbs/Hr	Penetration
1/8"	1/16"	430/450	29-32	65-75	Flat	0	14	100%
3/16"	1/16"	490/510	32-35	45-55	Flat	0	18	100%
5/16"	1/16"	550/570	32-35	40-50	Flat	0	22	100%
3/8"	1/16"	560/580	31-34	40-45	Flat	1/16"	23	100%

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

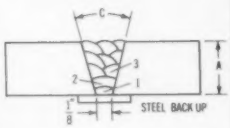
BUTT WELD (Both Sides)



Stock Thickness A	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Notes
3/8"	1/16"	410/430	32-36	20-25	Flat	12-16	Weld on both sides at the same conditions
1/2"	1/16"	480/500	32-36	15-20	Flat	16-19	Same conditions

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

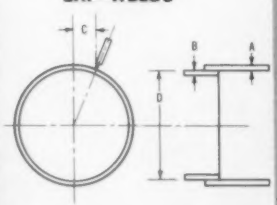
SPACED "V" BUTT WELDS



Stock Thickness A	Layer	Wire Dia.	Amps	Volts	Travel Speed IPM	Weld Position	Dep. Rate Lbs/Hr	Angle C
3/8"	1	1/16"	420-480	29-31	15-18	Flat	16-22	30°
5/8"	1 & 2	1/16"	420-480 420-480	29-31 29-31	15-20 20-25	Flat Flat	16-22 16-22	30°
3/4"	1	5/64"	440-520	37-40	10-15	Flat	17-23	60°
to	2	5/64"	450-480	35-38	7-10	Flat	17-23	60°
1-1/2"	3 etc.	5/64"	450-480	35-38	10-15	Flat	17-23	60°

A. O. Smith automatic wire No. CO-86 was used in all the above instances.

CIRCUMFERENTIAL LAP WELDS



Stock Thickness A	Stock Thickness B	Amount of Flood C	Dia. D	Wire Dia.	Amps	Volts	Travel Speed IPM	Dep. Rate Lbs/Hr
.088"	.154"	2-7/8"	12"	5/64"	550/560	30	120	19
.088"	.147"	2-5/8"	14"	5/64"	530/540	30	100	18
.101"	.161"	3"	16"	5/64"	570/580	30	100	20.5
.113"	.187"	3-3/8"	18"	5/64"	580/590	30	100	21
.123"	.204"	3-1/2"	20"	5/64"	600/610	31	100	23

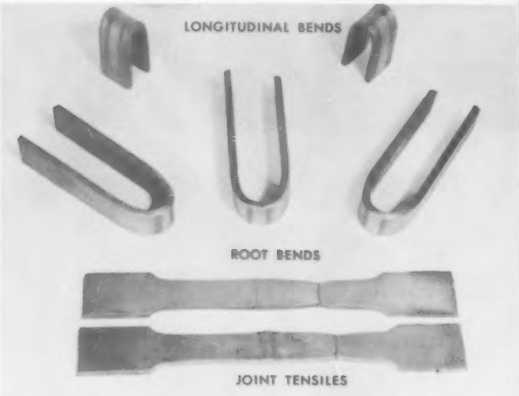
A. O. Smith automatic wire No. CO-86 was used in all the above instances.

Examine these A.O.Smith

A. O. Smith C-OMANUAL and C-OMATIC processes produce x-ray quality, low-hydrogen welds with mechanical properties equal to the best produced with coated electrodes.

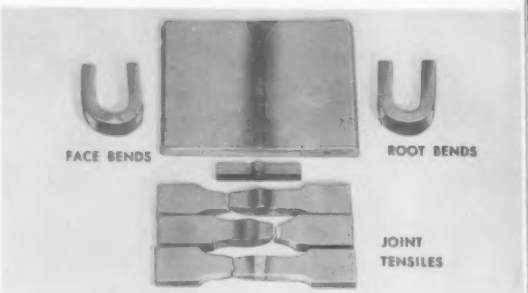
Single Pass Butt Welds

— in A-285 steel. Face and root bends indicate superior ductility. Cross section of the butt weld shows extent of penetration. Radiographs easily passed Class 1 Boiler Code standards.



Double Pass Butt Welds

— in ⅝" medium carbon steel. Face and root bends indicate excellent ductility. Sufficient strength also, as joint tensiles failed in the stock at about 85,000 psi.



HIGH-SPEED CASTING SALVAGE

Foundries are building up blowholes and other imperfections in castings at high speed and low cost with A. O. Smith C-OMANUAL welding. Operators put down metal at rates up to 30 lbs. an hour, compared with 10 pounds or less with manual welding. Deep penetration and weld quality are assured. No flux or slag to chip. Operator can start at the bottom and work to the top without stopping.

FILLED BLOWHOLE IN CASTING

(Cross Section)

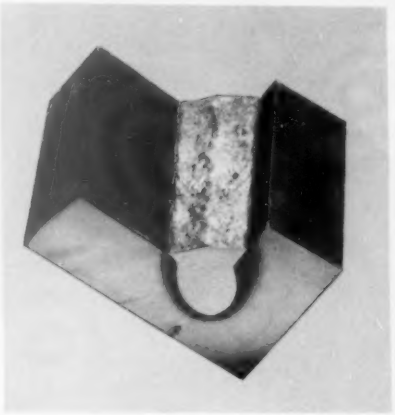
Built-up blowhole in a salvaged foundry casting is 4½" deep and 6" in diameter. On jobs like this, A. O. Smith C-OMANUAL puts down weld metal much faster than conventional electrodes.

CO_2 physicals, too

TYPICAL MECHANICAL PROPERTY TESTS

As-Welded, Not Artificially Aged

A. O. Smith Wire	Type Weld	Yield Strength	Tensile Strength	% Elong.	Red. of Area
CO-86	Butt	58,000	73,000	30.0	62.3
		60,500	72,000	28.5	61.8
CO-85	Butt	54,800	72,400	30.5	64.5
		54,300	71,900	30.5	64.9



◀ POSITIONED FILLET

Single layer fillet weld deposited in ¾"-thick ASTM A-285 steel. Note depth of penetration and smooth surface appearance of the weld. A. O. Smith 1/16" CO-85 wire was used at 470 amps, 40 volts.

BEND TEST RESULTS

Welds made with the CO_2 processes were entirely satisfactory after bending to 180°. Tests proved that weld metal of excellent ductility are obtained.

▲ PENETRATION

Welds made with A. O. Smith C-OMATIC and C-OMANUAL have a wide and well-rounded weld penetration, as this photograph clearly shows.

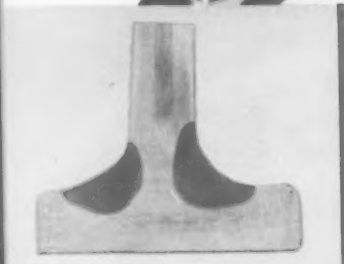
HIGH PRODUCTION SET-UP

C-OMANUAL in use on X member crossbar of an automotive convertible frame. This is a high production set-up where the operator is, in effect, making an I-beam section — welding two siderails on a center web. Work is positioned for downhill (20°) welding. Speeds between 100 and 200 ipm are achieved. Work requires NO degreasing or cleaning. Slag cleaning eliminated. Virtually no rejects.

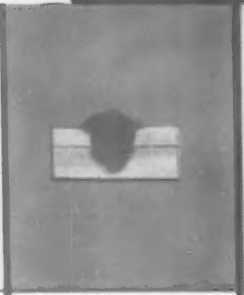
A. O. SMITH AUTOMATIC WELDING WIRE

Designed specifically for top performance CO_2 welding on a wide variety of steels. Available in many diameters, packages and types.

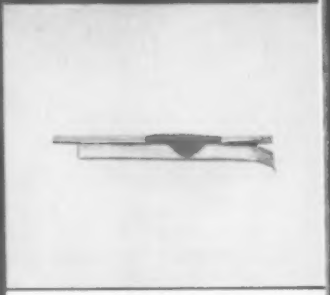
NEW *from* A.O.Smith



Timed Fillet Button Weld



Typical Burn-Thru Button Weld



Burn-Thru Button Weld — Light Gages

Here is how you do it...

"Just slip the right button-weld nozzle over the C-OMANUAL gun barrel, tighten up the clamping screw, and the operator is set to go."

"To make a button weld, he positions the nozzle on the work, pulls the trigger, holds it until the automatic timer stops the welding. No helmet needed!"

...Button welding with a hand gun!

- A finished weld that resembles a button or rivet head.
- Made with a lightweight hand gun using the CO_2 C-OMANUAL process.
- No special training or skill required of the operator.

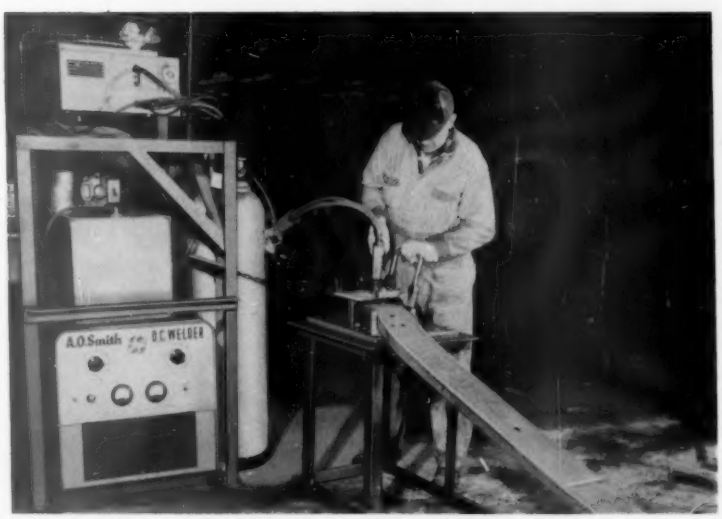
Button welding can best be described as an economical and improved substitute for spot (resistance) welding and riveting with applications far beyond those two processes.

Employing the basic C-OMANUAL equipment (see pages 4 and 5) plus a Button Welder Adapter Kit consisting of a choice of nozzles and a cycle timer, the operator merely positions his gun on the work, pulls the trigger and holds until the welding stops — automatically. Cycles can be varied from three (1/20th second) to 360 (6 seconds) depending on stock thickness (3/64" to 3/16").

Wire feed rolls are designed to feed weld wire without wire distortion. Each unit is shipped with dual wire feed rolls, including one spare, for driving 1/16" diameter wire. Rolls for 3/64", 5/64" and 3/32" diameter wires are also available.

Any of the standard joints can be button welded (lap, fillet, butt, etc.) without a need for special operator training or skills. And every "button" is exactly the same — as pre-set on the timer. There's no flux to clean — no need for a welding helmet. Operators love it.

The button weld process gives high quality weld metal, high deposition rates, deep penetration, low hydrogen weld metal, visible arc, no slag removal, and low overall costs.



No Possibility of Operator Error

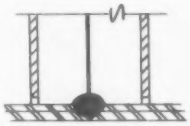
Button-welding a reinforcement bracket with the A. O. Smith CO_2 process. In this case five button welds are grouped in a relatively small area, with a simple aperture fixture used for positioning. Steel gages are 0.109 for the top piece and 0.145 for the lower piece. Each weld requires approximately one-half second (30 cycles), which is pre-set on the automatic timer. Any possibility of operator error is eliminated. Amperage: 420 at 39 volts. Visible weld, and no cleaning or degreasing of work necessary. The operator requires no helmet.

Be right on the "button" the

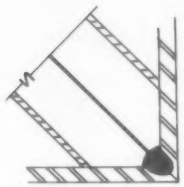
Slip-on Nozzles For Different Joints

Nozzles for burn-through button welds and fillet tack welds along with the cycle timer, are furnished with each "Button Gun" kit.

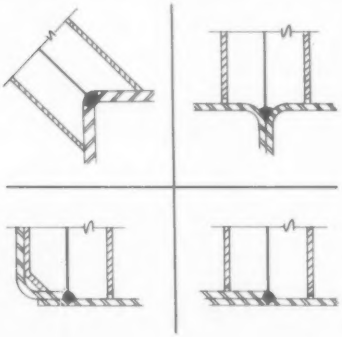
1. Standard burn-through button weld nozzle



2. Fillet Tack Button Weld Nozzle



Special nozzles for varied applications can easily be made to suit your job requirements.



A.O.Smith way

Reliability of weld quality even on uncleaned steel, extreme flexibility, and low cost of operation make A. O. Smith's CO_2 button gun a valuable new high-speed production tool. Note that it is ideal for tacking. No skill on the part of the operator is required: the supervisor sets the cycle, the operator positions the nozzle, pulls the trigger, and gets a perfect button weld every time.

CO_2 BUTTON WELDS

Stock A	Stock B	Wire	Amps.	Volts	Cycles
.081	.081	1/16"	380	37	23
.089	.089	1/16	360	37	25
.119	.119	1/16	390	37	30
.142	.142	1/16	460	40	33
.195	.195	1/16	460	47	75
.215	.215	1/16	465	48	98

CO_2 EDGE BUTTON WELDS

Stock A	Stock B	Wire	Amps.	Volts	Cycles
.081	.081	1/16"	280	40	23
.081	.081	3/64	200	37	42
.089	.089	1/16	290	40	23
.089	.089	3/64	200	37	35
.119	.119	1/16	370	37	35
.136	.136	1/16	350	37	40
.183	.183	1/16	380	37	42

Button Welding Doubles Production

Photo (at left) shows an operator button-welding a cover plate to a control arm. This job was formerly hand-arc welded at a rate of 2,200 pieces per shift. Using the button gun, the rate was upped to 4,800 pieces per shift. From 5% to 8% of the parts manually welded required repair. Only ½ of 1% of the button-welded parts required repair.

On this job two button welds are made on each piece (0.180 to 0.180 stock thickness) at ½ second each; 425 amps at 39 volts.

An interesting sidelight concerned a job requirement of 1/16" maximum button height. Problem was solved by drilling a ¼" hole in the top piece and actually inserting the wire of the button gun in the hole. The result was a virtually flat button.

YOU KNOW THIS MAN . . .

sure you do! You've seen him in the movies, on television, and perhaps on the stage. John Carradine — a star in all three mediums. During a visit to Milwaukee, he visited A. O. Smith, discovered the dramatic art of welding, and got right into the middle of it.

IF YOU have a role in which CO_2 welding can play a great part, and you want to see a try-out — call your "man from A. O. Smith."

a frank report

by **A.O.Smith**

on new techniques and new equipment for the most advanced automatic and semi-automatic CO_2-shielded welding processes.

see what you can do with CO_2

If you have a problem in welding automation, remember — A. O. Smith C-OMATIC for the welding equipment and A. O. Smith Engineering Service Corporation for the fixture. There's no job too complicated and there's only one responsibility.

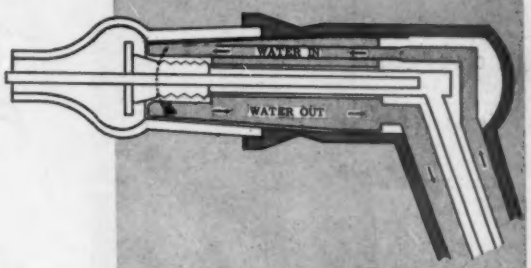
the TOP TIG welding TRIO

the torch

TEC VISUWELD TORCH

The proven tungsten inert gas welding torch contains all these exclusive features: the lightest weight... only 3 ounces... maintenance free... no parts to wear or leak... 3 to 350 amps.... topped with a Visuweld transparent gas nozzle which presents a clear, unobstructed view of the weld area at all times.

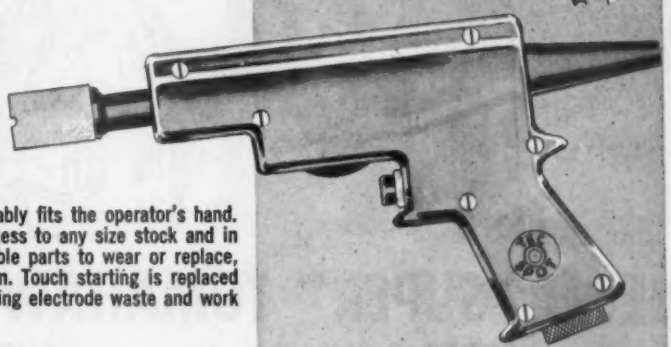
Unparalleled tip-of-the-torch cooling system continuously releases cool water where it's needed most... at the tip-of-the-torch. Guaranteed gas and water leakproof due to one piece torch head construction without "O" rings, threads, or gaskets.



the gun

TEC SPOT GUN

This TIG spot welding tool perfectly bridges the gap between resistance welding and TIG arc welding. The TEC Spot Gun has been designed to increase production output and replace expensive spot welding operations. The lightest weight, most compact spot gun ever made, it comfortably fits the operator's hand. Weld up to, and including ⅛" thickness to any size stock and in any joint design. There are no movable parts to wear or replace, permitting maintenance free operation. Touch starting is replaced by high frequency arc starting, reducing electrode waste and work contamination.



the control

TEC SPOT CONTROL

This perfect welding mate for the TEC Spot Gun, converts any DC power source into a new TIG spot welding machine. A choice of preset welding times can be selected at the gun itself. The TEC spot control unit is light and compact, with easy to read controls. It is the only control unit of its kind. This portable TEC spot control unit can easily be connected to any DC power source.

all from —TEC

Write for full information

TEC TORCH COMPANY, INC.

300 PATERSON AVE., CARLSTADT, N. J.

ATLAS | WIDE - BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

for the welder who thinks he has everything!

NEW! "SUPER" TOMAHAWKS

Get these SUPER features in the new "SUPER"!

1 Redistribution of weight—The weight's in the head for more production with less effort.

2 New light weight, tempered aircraft aluminum shaft. Unbendable—unbreakable. Can't turn or come loose.

3 New Atlas "wide-blade" design. Wider chipping edge further increases chipping speed—adds to life of tool.

4 Formed hardwood grip that fits the hand. Locked on shaft so it can't turn or loosen.

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS WELDING ACCESSORIES INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

Letters . . .

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Sustained interest

Sir: *Sarasota, Fla.*

Although I am now retired from the welding business, I find I want to keep up with the progress being made in the various fields of welding.

Having entered the welding field in 1916, I have watched welding develop from the toddling stage, of that time, to the present giant it is, in the metal-working field.

I first subscribed to the Welding Engineer in July of 1917. I consider your publication to be the leading one, devoted exclusively to the many branches and methods of welding. After entering the field in 1916, in Mobile, Alabama, I then worked in Detroit and in Peoria, during World War I. Then I opened a shop in 1920 at Alton, Illinois, and was continuously in business there, until December, 1956.

T. L. Dickerson

Where's the Bard?

Sir: *Chicago*

In the past we have seen, and greatly enjoyed, the Bard cartoons. However, recent issues of Welding Engineer have not contained the Bard's latest quips. What has happened to them?

A reader

—The Bard is back in this issue—on the Between Passes page. Often the exigencies of the publishing business make it seem like another poet was talking about this business, when he wrote:

"The best laid schemes of mice and men
Gang aft a-glae;
An' lea'e us nought but grief and pain
For promised joy."

High praise

Sir: *Chicago, Ill.*

I have enjoyed your magazine, and have nothing but the best to say for the contents and your service. Thank you for everything, and I hope to enjoy your magazine for years ahead now.

R. H. MacDonald

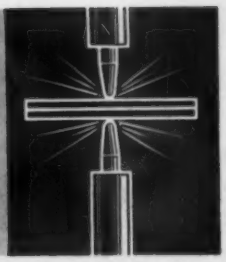
No other advertising touches the reader's job interests as much as business paper advertising.

P.R. MALLORY & CO. Inc.

MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

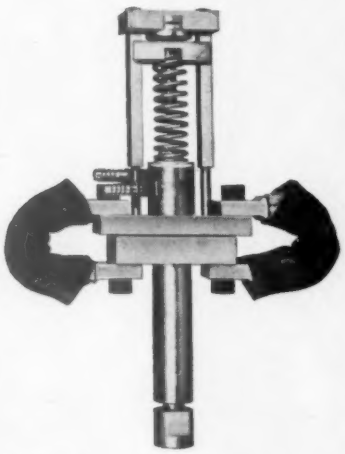
P. R. Mallory & Co. Inc., Indianapolis 6, Indiana



WELDING HINTS

Do you have the Mallory Resistance Welding Data Book?

It's one of the most complete reference books ever written on resistance welding. Over 500 pages of up-to-date metallurgical information and practical facts for designers and production men. Edited by Mallory welding specialists. You'll find it on the desks of leading welding men everywhere. The latest edition, in durable hard cover binding, is available from your Mallory distributor.



For welding "difficult" metals such as light gage brass and aluminum which have limited plastic range, use the new Mallory precision low-inertia holder. Wide range of pressures available with easily interchangeable springs. Ask your Mallory distributor.

Get More Welds Per Dollar with Cool-Running MALLORY Fluted Electrodes

How many welds can you get from an electrode? Part of the answer is determined by how cool the electrode runs. Excessive heat softens the metal, causes "mushrooming," wastes production time by requiring shutdowns for dressing tips. Mallory fluted electrodes have 70% more metal-to-water area inside them than round-hole types. Because they run far cooler, they make *more* welds before need for dressing. And they make *better* welds . . . because they don't flatten out and give you inadequate concentration of heating that can cause weak welds.

The exclusive Mallory fluted hole is available *without extra cost* in many types of Mallory straight, single and double-bend electrodes. It's one of the important extra values you get from Mallory—leader in resistance welding supplies for over 30 years.

A Mallory distributor near you carries a broad line of standard Mallory electrodes. He can give you immediate delivery of any of 200 different shapes and sizes. Before you go the cost of "special" electrodes, let him show you how a Mallory standard design can do the job for you without special cost.

NOW YOU CAN GRIND AND FINISH

NEW BAYFLEX DOUBLE-DUTY

Illustrations above show Bayflex Double-Duty in action, held at correct angle for weld bead grinding (top) and for finishing (bottom)

WITHOUT CHANGING WHEELS!

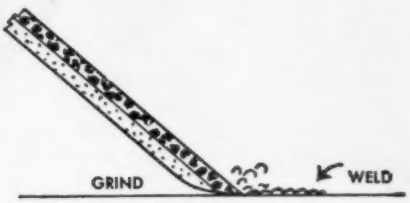
There are two important angles to consider before you buy new weld-grinding or finishing wheels. Bay State's new Bayflex Double-Duty raised hub disc-wheel has them *both!*

The "DD's" unique, two-layer construction gives you two grinding angles: One is 30° - 45° which gives you fast stock removal for grinding weld beads . . . and the other is 10° - 20° which gives you a finish without gouging, a finish so smooth it's just short of a polished surface.

The upper layer for weld grinding comes in a single, standard specification. The lower finishing or blending layer comes in your choice of five different grits (24, 36, 54, 80 and 120) for every type of finishing job from heavy steels through light stainless sheets to aluminum and copper.

Your Bay State representative is ready now to demonstrate the Bayflex Double-Duty in your plant under normal working conditions. Get in touch with him and see what he can do to cut costs and speed up your weld grinding. You'll find he's more than a good salesman . . . because he's an experienced abrasive specialist, too. *Better grinding at lower cost . . . that is his business.*

IS 2 WHEELS IN 1



Upper layer removes stock rapidly when disc is held at 30° - 45° angle.

Lower layer smooths and blends surface when held at 10° - 20° angle.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Mass.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles.
Distributors: All principal cities

ALL THIS

100% DUTY CYCLE

225 Amperes Rated Output

5 KW 115/230v AC

1 KW 115v DC

12.9 HP ONAN ENGINE

AND NOW

ELECTRIC STARTER

The world-wide respect and demand for this original Miller gas engine driven welder/power plant has never been greater. To this established popularity has now been added the convenience of Bendix drive electric starting as optional equipment on models AEA-200-L and AEA-200. Model illustrated and headlined is AEA-200-LE.

As a welder, as a power plant, as a pipe thawer, indeed, as a top hand from Canadian uranium mines to Brazilian cattle ranches — and on highway construction jobs and repair ships between — the AEA-200-L stands quite alone as "the finest in the field." In addition to optional electric starter, road trailers and rubber tired running gear are also available.

Other Miller gas engine driven DC and AC-DC welder/power plants to 300 amperes at 100% duty cycle. Full particulars will be sent promptly upon request, or a demonstration can be arranged at your convenience.

miller Electric Manufacturing Company, Inc., APPLETON, WISCONSIN

EXPORT OFFICE: 250 West 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

BETWEEN PASSES

welded bridges

Welding plays an ever-increasing role in the construction of bridges, but there are still many steel structures being erected by other means. Nevertheless, it is reassuring to read of a talk given by Charles S. Matlock, senior design engineer, Texas Highway Dept., Bridge Div., Austin Texas. Speaking in April before delegates to the 11th National Engineering Conference in Birmingham sponsored by the American Institute of Steel Construction, Matlock described design of the Buffalo Bayou Bridges which have won several top prizes (*WE*, January, 1958, p. 29). He said that all types of feasible construction—riveted, bolted, welded—had been carefully studied, and that welded plate girder design was the "most efficient and economical."

Most of the newer bridges dotting Texas highways make use of welded girders. Prior to 1948, riveted construction was employed almost solely.

more on campanology

Although a procedure for repair welding of bells has been part of *The Welding Encyclopedia* for many years, it had been some time since an actual application report was made in the pages of WELDING ENGINEER—until April, that is. Two months ago in this department we published an account [of such a repair] sent us by an Irish campanologist, C. J. Robb. His question "Have many bells been welded in America?" has been at least partially answered by Harold Card, a former editor of WELDING ENGINEER.

Harold writes us that ". . . the subject would pop up occasionally through the years, though a broken bell is not an everyday happening. One nice job . . . was done by Storts Welding Co., Meriden, Conn. The bell is 40 in. high and 36 in. in diameter at the bottom. It was cast in 1853 and installed in Christ Church in Watertown, Conn. Principal alloying elements were zinc (10%) and tin (17%). The voice of the bell was in the key of A flat, and the tone was restored. This was not a first or last or biggest or best . . . just another bell job, with enough data to point up the fact that it can be done . . . that it takes a good oxyacetylene craftsman to do it."

"Congratulations, this is the earliest you've been late."

shipbuilding

Japan topped the word in shipbuilding in 1958, according to Lloyd's Register of Shipping. West Germany went into second place, closely followed by Great Britain and Northern Ireland. Sweden was next, slightly ahead of the United States.

Note the top two. Not many years ago both were recently-defeated nations of World War II.

sign of the times

Speaking of World War II, which was back in the 50-caliber machine-gun era, a fighter plane (then known as a pursuit plane) could fire on an enemy at small cost. But today, the missiles these planes fire cost about $7,000 each. But wait . . . that's cheap; with an atomic warhead, the cost is $243,000.

Talk about inflation!

the corporation

When the history of our era is written, development of the modern corporation may prove the greatest invention of all. This is the thesis of Henry B. du Pont, a vice president of Du Pont Co., as recently promulgated in a lecture at the Franklin Institute, Philadelphia.

A vital factor in progress, the corporation has proved the most effective device man has ever known for extending technology. Noting the slow rate of human progress over the centuries, du Pont said the industrial organization as it is now recognized "came too late to aid earlier inventors," but declared: "In this century, it has changed the world." Those earlier geniuses faced the problem not only of getting backing for their ideas, but in actually creating inventions . . . they could only make a part-time job of it while they tried to make a living doing something else.

The modern industrial establishment is the agency which made pursuit of technology a full-time job, du Pont stated, and . . . research efforts of universities, private foundations and government laboratories contribute importantly to advancement of American science and engineering. These institutions could not exist but for the wealth generated by American industry.

We're not sure corporations need defending, but the above does make a good defense against a lot of critics.

the Bard

Shop condition: Another Friday RUSH job

. . . for't must be done tonight
Macbeth, Act III, Sc 1

Wear-O-Matic Hard Surfacing is 3 Ways Better

1 *Faster . . . More Economical*

The Wear-O-Matic process of semi-automatic hard surfacing is continuous welding with manual control of the arc. However, unlike manual welding with stick electrodes, there is no time consuming slag cleaning or electrode changes. Higher deposition rates, 3 to 5 times faster than stick electrodes, greater deposition efficiency, 85 to 95%, plus more available arc time add up to savings of 40 to 50% over manual hard surfacing with stick electrodes.

2 *Uniform Resistance to Wear*

The superior wear resistance qualities of Wear-O-Matic hard surfacing wires is the result of closely controlled manufacture, properly balanced alloys and fluxing agents, and precision drawing. Wear-O-Matic 7/64″ diameter open arc wires are precision drawn to true wire diameter ± 0.002″ and through drawing are densely compacted assuring an easier feeding wire that will not crush in the feed rolls or bind in the feed cable. Dense compaction and closely controlled fabrication combine to provide a weld deposit more uniform in chemistry and metallurgy resulting in uniform hardness and greater wear resistance throughout the deposit.

3 *Greater Efficiency and Ease of Application*

Here's a hard surfacing combination *designed* to cut maintenance cost through the *profitable* utilization of your welder's time. Wear-O-Matic wires in WELD-PAKS are the key to greater efficiency of both semi-automatic equipment and operator. Each WELD-PAK contains 100 pounds of wire packaged in a "dead cast" resulting in tension free, snarl free feeding. Because the WELD-PAK contains 2 to 4 times more wire than standard coils, the amount of time spent handling wire is lessened, providing more time for welding. WELD-PAKS are easier to handle and store; and on the job, the lid can be replaced after use assuring dirt and dust free wire when you are ready to resume welding. From set-up to finished job, the Wear-O-Matic process is easier and faster, eliminating overtime or providing more time for other maintenance jobs. Job test this time saving process in your own shop. Request Bulletin HS-102 for complete details. Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.

Wear-O-Matic Wire Feed Unit
$279.00 f.o.b. York, Penna.
or El Segundo, Calif.

Weld-Pak is the trade name for this exclusive Wear-O-Matic package.

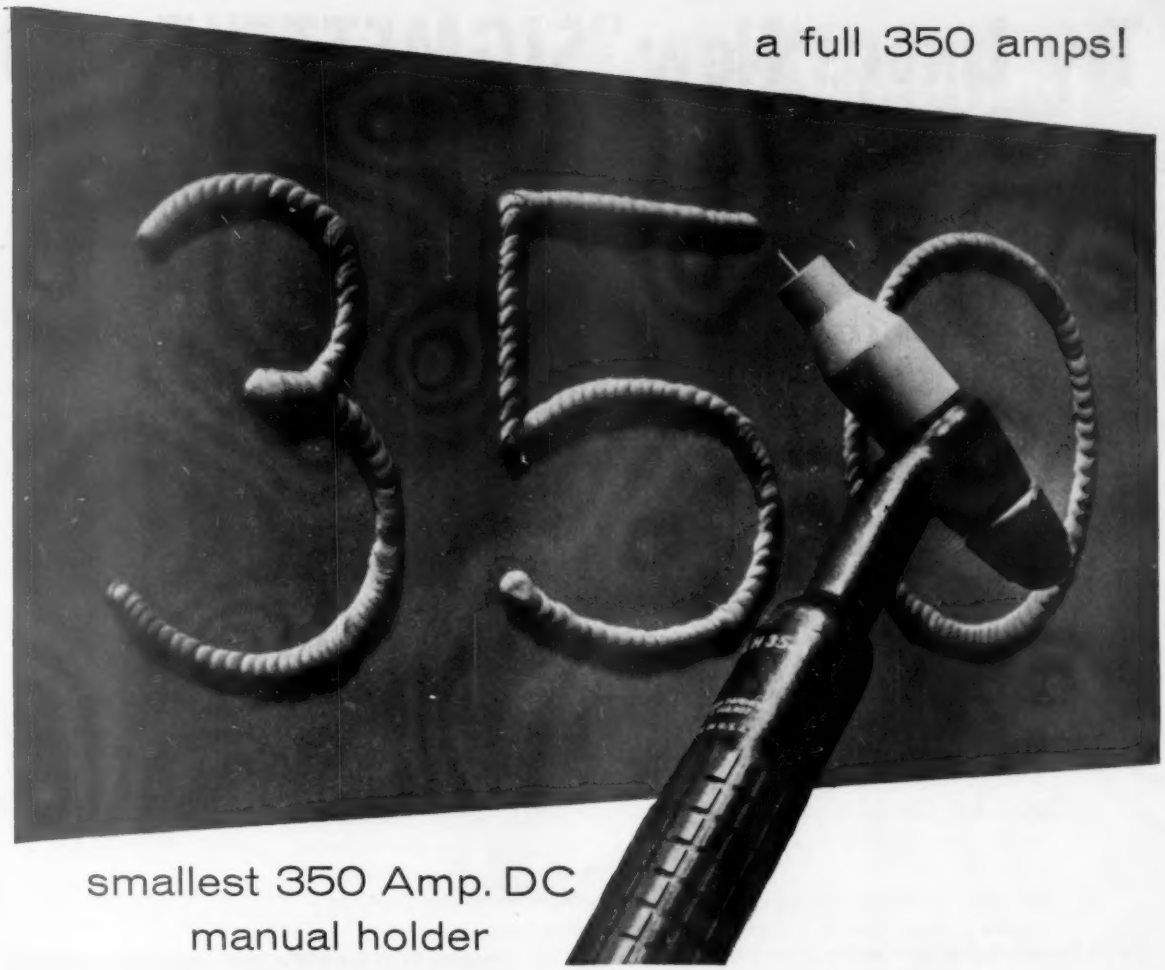
Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

NO FINER ELECTRODES MADE . . . ANYWHERE



AIRCO'S H35-B HELIWELD HOLDER

new design • new light weight • new economy

Using tungsten electrodes as short as 2" in length, the brand new Airco H35-B Manual Heliweld Holder can go to work in more confined spaces than any other holder.

It operates at a continuous duty rating of 350 amperes DCSP, or 300 amperes AC.

With a new Airco H35-B in hand you can heliweld stainless steel, aluminum, copper, magnesium and other alloys and metals . . . from paper-thin gauge to 1/8" or more, depending upon the metal and current you use. Special body material insulates against high temperatures.

The Airco H35-B does the job at lower operating cost. Stub loss can be as little as 13/16". Metallic nozzles are not needed. Reduced gas flow saves you money. Less down time, because there's no high frequency leakage. Connections are a breeze. For information see your Authorized Airco Dealer. He's listed in the Yellow Pages. Or, contact Airco direct.

AIRCO®

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N.Y.

Offices and authorized dealers in most principal cities

On the west coast—
Air Reduction Pacific Company

Internationally—
Airco Company International

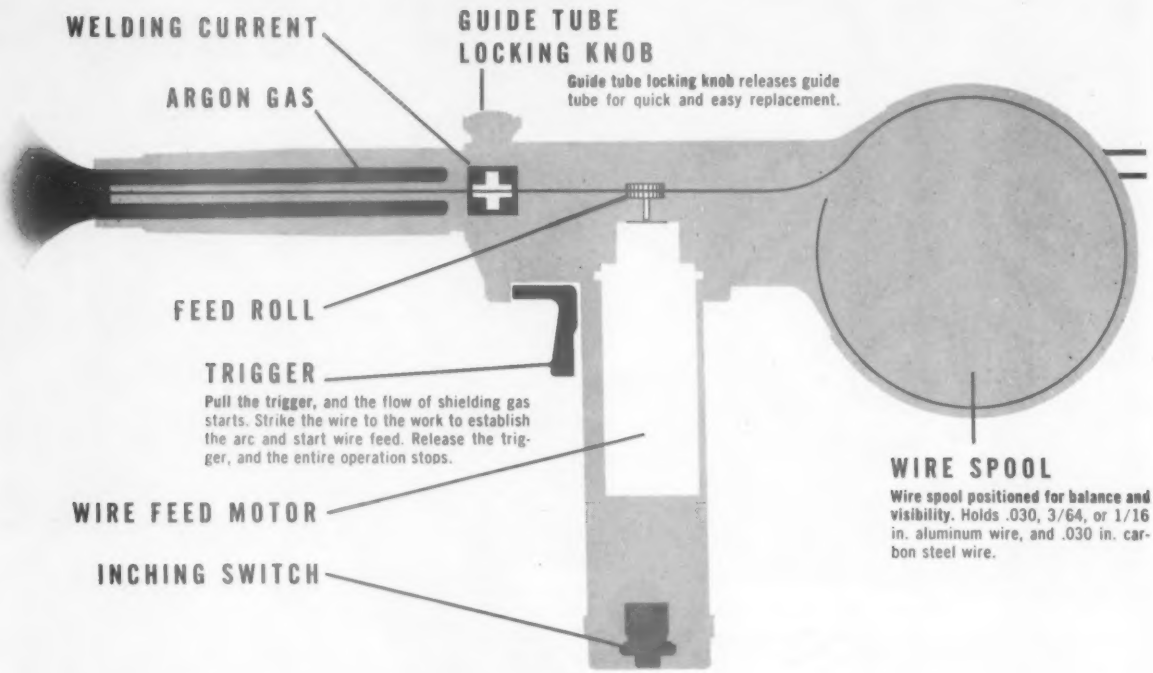
In Cuba—
Cuban Air Products Corporation

In Canada—
Air Reduction Canada Limited

All divisions or subsidiaries of Air Reduction Company, Inc.

Try LINDE'S New "SIGMETTE" Torch!

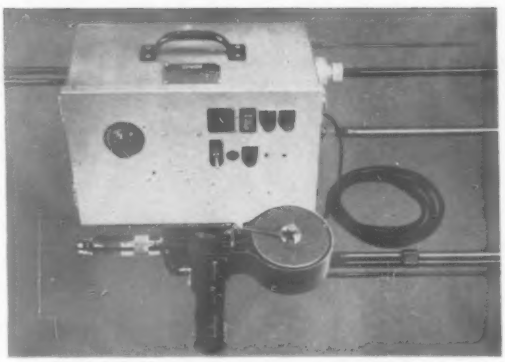
—PORTABLE, COMPACT


WELDING CURRENT
ARGON GAS
GUIDE TUBE LOCKING KNOB
Guide tube locking knob releases guide tube for quick and easy replacement.
FEED ROLL
TRIGGER
Pull the trigger, and the flow of shielding gas starts. Strike the wire to the work to establish the arc and start wire feed. Release the trigger, and the entire operation stops.
WIRE FEED MOTOR
INCHING SWITCH
WIRE SPOOL
Wire spool positioned for balance and visibility. Holds .030, 3/64, or 1/16 in. aluminum wire, and .030 in. carbon steel wire.

Here's the torch that goes to the job—lets you work in any position . . . in confined spaces . . . at distance remote from the power source!

Designed for Sigma welding of light metals, the "Sigmette" torch is compact and sturdy. Notice the thin silhouette and position of the spool for complete visibility. Torch and control are completely insulated and grounded—the operator is protected from electrically "hot" parts. And the only maintenance tool needed is a screwdriver!

Find out how Linde's new "Sigmette" torch can speed your operations, bring new economies through its advanced design features. For a free demonstration and detailed information, mail the coupon today or call the nearest Linde Office.



Complete unit—torch weighs 3 pounds, 1 oz.; control weighs 19 pounds, 2 oz.; Current rating, 125 to 200 amp.; Welding power, direct current reverse polarity

Dept. WE-6, Linde Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

☐ Please send complete facts on the new "Sigmette" torch.
☐ Please arrange to let me try it.

Name_____

Firm Name_____

Street_____

City_____ Zone_____ State_____

"Linde", "Sigmette" and "Union Carbide" are trademarks of Union Carbide Corporation.

Linde UNION CARBIDE

JUNE, 1959

Welding Engineer

ESTABLISHED 1916

Sixty years of service

SIXTY YEARS AGO a new magazine, The Acetylene Journal, made its debut. "Devoted to acetylene lighting and kindred subjects," it was a predecessor and companion publication of WELDING ENGINEER.

To those familiar with acetylene in June of 1899, it was evident that this gas' most valuable use would be as an illuminant. There was no doubt that acetylene would light the way.

In early issues of The Acetylene Journal, many photographs compared the acetylene light's brightness with the dimness of 19th century electric lights, just then coming into use.

Seven years later in its August issue, the magazine presented the first examples of acetylene used for welding. Oxyacetylene welding applied to various manufactured items of cast aluminum, cast iron and copper were detailed for the readers.

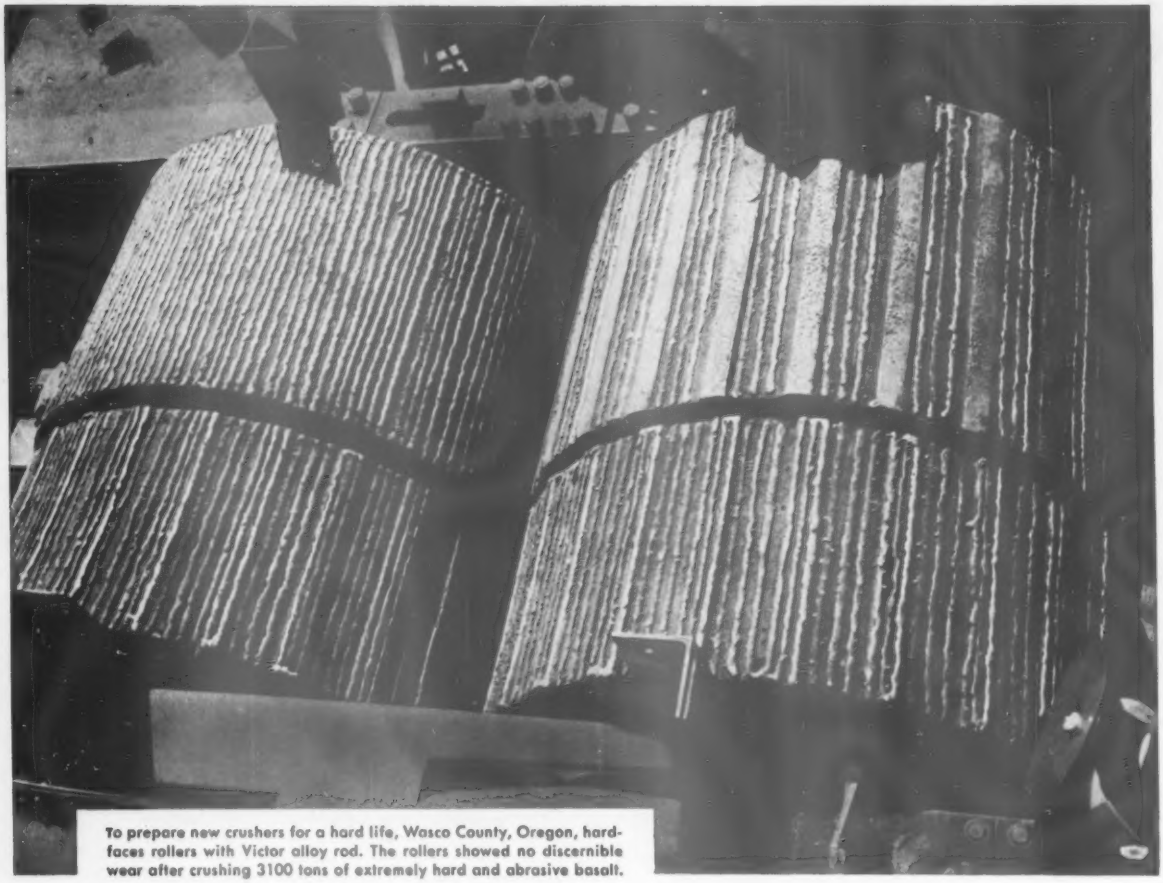
And readers became so interested, that soon an advertisement appeared announcing the availability of acetylene welding and cutting equipment. Other advertising followed close behind. Welding was on its way.

This modern joining method has made great strides since then—and the various welding processes have contributed more to our well-being than the old-timers ever dreamed possible. It is surprising, however, how many basic principles discussed more than 50 years ago are still applicable.

Glancing through The Acetylene Journal and WELDING ENGINEER, of which it became a part, you become aware of how acetylene *has* "lighted the way," not necessarily as an illuminant—but as a means to progress.

From a small light, it has grown into a valuable industrial gas for joining and severing materials, and is even more important in production of artificial rubber, plastics and innumerable other items from the chemical field—providing a better way of life.

All this has happened in 60 years—the 60 years in which The Acetylene Journal and WELDING ENGINEER have served the acetylene industry.



To prepare new crushers for a hard life, Wasco County, Oregon, hardfaces rollers with Victor alloy rod. The rollers showed no discernible wear after crushing 3100 tons of extremely hard and abrasive basalt.

Lifesaver for new or used equipment **VICTOR Hardfacing Alloys**

Wasco County, Oregon, uses lots of crushed basalt. This rock crushes readily, yet is extremely hard and highly abrasive, consequently tough on rollers. So, as standard practice, Supt. Wayne Weeks hardfaces all rollers in brand new crushers, before ever they crush a single basalt rock. He reports hardfacing of new equipment prevents excessive wear of surface material, thus maintaining roller size during the work hardening period.

On this new crusher, he used 200 lbs. of Victor #0 semi-automatic wire, size 7/64", to hardface roller faces, and 50 lbs. of tube Victorite coated for finish work around the roller edges. Longer crushing life will quickly pay for the rod.

You, too, can save money and extend the life of equipment subjected to abrasion, impact and heat. Simply make it standard practice to hardface both new and worn equipment with Victor alloy rods. Complete line of 27 different hardfacing rods assures you a right rod for every hardfacing need. Full range of sizes for both acetylene and electric AC and DC applications, either hand, automatic or semi-automatic. Order a supply from your Victor dealer TODAY.

FREE Victor Hardfacing Manual shows you right rod to use and how to apply it. Write us NOW for your copy.

VICTOR for welding

Profitable dealerships open; inquire now!

VICTOR EQUIPMENT COMPANY 42

ALLOY ROD AND METAL DIVISION

13808 E. Imperial Highway, Norwalk, Calif. • Wakita, Oklahoma

Welding Engineer *a special report*

Cable prices and sales on way up, survey shows

YOU CAN EXPECT to pay more for welding cable this year, especially if you use copper cable. If you use aluminum cable, a price hike is not so imminent but is highly probable.

Some copper-cable manufacturers have already boosted prices and foresee similar boosts before the year is out.

A survey by the Research Dept. of Welding Engineer Publications, Inc., shows that only one manufacturer (of the aluminum type) feels there will not be an increase in price, but even he qualified it by adding, "Year-long price trends are subject to many factors . . . not foreseeable on a long-term basis."

Predictions on these price hikes range from 7% to 20%. Most of the respondents blame their rising copper costs for the higher welding-cable prices.

Despite these increases in costs to you, the manufacturers foresee an improvement in their sales for 1959, with estimates ranging from a non-commital "We expect to exceed last year's sales" to a 60% increase in copper sales and a highly optimistic 350% boost in aluminum sales.

Sales and improvements in cable are the only two areas in which the makers reach unanimous agreement, the WE survey shows. On the latter topic, it is more correctly "near unanimous" since one respondent feels that only minor developments can be expected within the next two years.

Those who expect major developments in the future disagree as to the course these improvements will take. The majority (60%) anticipate improved cable jacket construction because of better compounds and continued rubber research. Others feel the only possible improvements lie in adoption of colored jackets and a possible trend to "limp" cable.

Disagreement was again in evidence on the question of what each manufacturer considers the most important development in welding cable during the past five years. Jacket compounds are high on the list, but votes also go to separator materials, introduction of aluminum cable, printed reel coil, cable-connection supports, jacket grippers, and merchandising and packaging.

Cable used in arc welding has been adapted for other applications far removed from our industry, the survey further reveals. Some of them include: as power cables for movie set and stage lighting, as booster cables in the automotive industry, as grounding cables for high-voltage power lines, and as grounds for rectifiers.

As might be expected, manufacturers indicate a prejudice in favor of their specific type of cable—copper or aluminum—when asked if they foresee a trend toward aluminum. Copper-cable representatives answer "no," while aluminum-cable makers say "yes."

One of the latter confessed he notices only a "slow trend."

Higher prices should prod many fabricators to more careful use of welding cable. Although manufacturers look for greater sales this year, they are not reluctant to decry the abnormal abuse that shortens cable life drastically.

As one put it, "Welding cable seldom dies a natural death. We use materials which under normal circumstances should result in a life expectancy of 20 years or more. Yet, because of . . . abuse, replacement on a yearly basis is not uncommon."

Life of your cable can be extended by following simple rules:

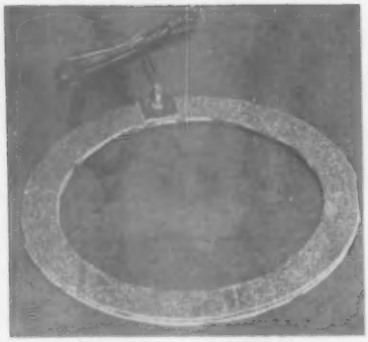
(1) Use the right size cable. If too small, it will overheat, thus shorten life of the cable jacket itself.

(2) Make sure all connections are tight. Check them periodically.

(3) Safeguard the connection at the welding machine to prevent unnecessary bending and twisting.

(4) Use a ground cable—not welded strap steel—and make sure it is the same size as your electrode cable.

Superior performance and longer life in actual service will result, and that is what you want—more hours of service per dollar of cost, rather than just initial purchase cost.



VARIATION of explosive cutting technique using a circular form. In photo above, sheet explosive is in place and primed to cut a 8-in.-diameter disc from ½-in.-thick 1020 steel plate. Photo at right shows result.

Acetylene chalk, predicted by WE in January, 1956, has yet to become a reality, but here's the next best thing . . .

Flexible sheet-explosive for metal cutting

ONE OF THE BIGGER industrial "booms" heard in recent months was the introduction of explosive forming and welding.

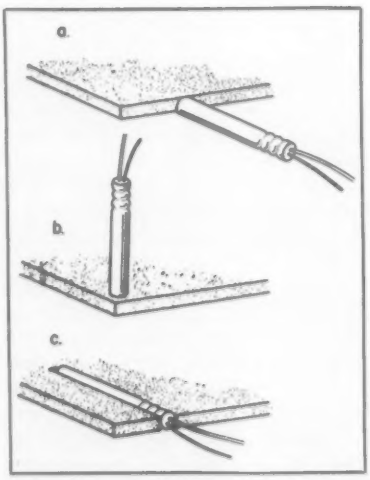
(See "Explosive welding . . ." *WE*, April, p. 61.)

Now this use of explosives in industry has been extended again with the help of a flexible sheet-explosive manufactured by E. I. du Pont de Nemours & Co., Wilmington, Del.

Termed EL-506A, the flexible sheeting can be used in explosive cutting and hardening of metals, and offers a number of advantages to manufacturers dealing with missiles and other destructor units.

According to Du Pont, the sheet explosive's main advantages are: (1) maximum cutting or destructive action with minimum weight of explosive unit required; (2) easy application; (3) safety in storage, handling and installation; (4) increased reliability because of few connections required for initiators and boosters; and (5) maximum uniformity of sheet explosive formulation.

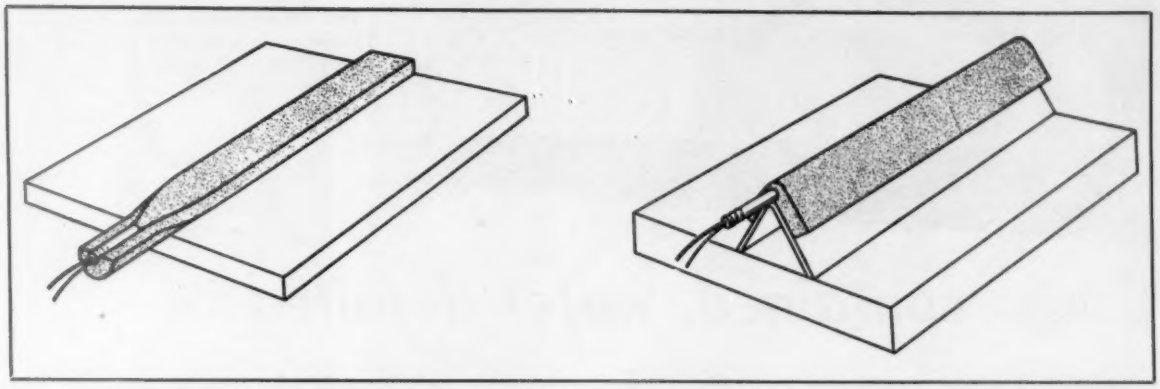
(Because it is uneffected by water, underwater demolition work is another field of application.)



SKETCHES illustrate three proper methods of initiating sheet-explosive with blasting cap. In all cases, butt-end of cap is in contact with the explosive.

The sheet explosive can be cut easily with a fixed-blade knife to the right size and shape. It is then molded to fit the contours of the work, insuring the right amount of explosive in the right place.

Made of PETN (pentaerythritol



BASIC method of using sheet-explosive for cutting is shown at left. Flat strip is fastened in pattern of cut to be made. Drawing at right shows a shaped charge with a brass liner. Angle should be 60 to 90 deg and explosive should extend to mid-point of the liner sides. Liner thickness increases as explosive loading exceeds 10 grams per sq in.

tetranitrate), EL-506A is combined with other ingredients to form tough, flexible sheets measuring 10 by 20 in. Sheets are available in a number of thicknesses, but any required unit loading can be obtained by combining several thicknesses.

Application involves cutting the sheet to desired shape and size, applying adhesive to both the sheet and the part to be cut, then sticking it in place, making sure of bonding at every point. A close bond between explosive and work insures maximum utilization of the detonation pressures resulting.

The sheet-explosive is comparatively safe when handled with proper precaution. When an 18-lb steel ball was dropped from 10 ft onto a 2-in. square section resting on ½-in.-thick steel, it failed to detonate. Firing 30-caliber bullets from 45 ft also failed to initiate the sheet-explosive.

For consistent initiation, Du Pont uses a high-powered electric blasting cap designed for this application.

The basic method of explosive cutting is to fasten the sheet (cut as a flat strip) in the pattern of the cut to be made. The firm's rule-of-thumb is strip width should be approximately twice the material thickness. Strip thickness will depend on the nature of the material.

If more than one layer of sheet-explosive is used, joints should be at different locations in each layer.

(Cutting action of the explosive is just as effective if two strips of the same total loading are placed directly opposite one another on each side of the plate.)

The flexible sheet can also be used as a linear-shaped charge with a metal liner. The cavity directs forces along a plane bisecting the angle or the arc formed by the explosive. Hot metal particles from the liner combine with the force plane to provide exceptional cutting ability, according to the company.

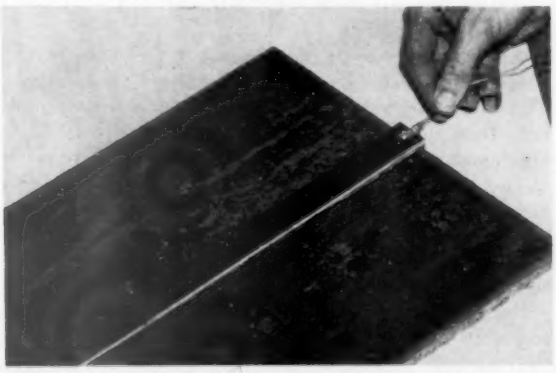
Because of its convenient form and safety, additional uses for this sheet-explosive are already apparent. Prehardening of castings and parts made of manganese (Hadfield) steel have been accomplished by inducing a shock wave in the metal through detonation of the sheet-explosive placed directly on the metal's surface.

This explosive hardening, noticeable 2 in. below the surface, doubles tensile strength, quadruples yield strength and increases hardness some 300 Brinell points—without dimensional change of any consequence.

(The amount of explosive used will determine the degree and depth of hardness.)

Another advantage of this explosive hardening is that defects (porosity, tears, flaws, inclusions) are easily detected in the form of dents or fractures.

Explosive technology seems to have the answers to many of industry's oldest—and newest—problems.



DOUBLE thickness of sheet-explosive, 1-in. wide, is glued to ½-in.-thick steel plate and primed with blasting cap in photo at left.

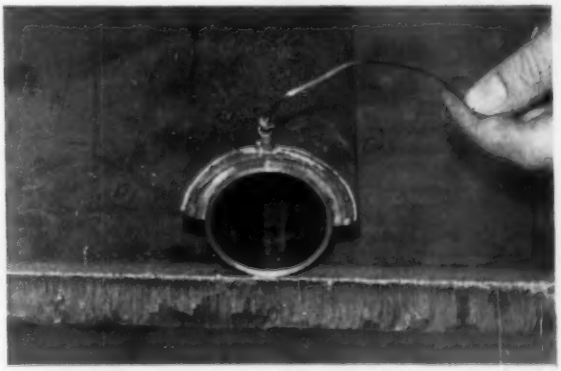


Photo at right shows copper tubing used as liner in cutting 1-in.-thick steel plate.

THIS Super-Jumbo PS-2 closed-hopper freight car required 399 lb of manual electrodes, 135 lb of automatic wire and 159 lb of flux for fabrication.

Cargo contained, water derailed by hopper cars hauling products cross-country

by **Ken Rhodie**

WITH EVER-INCREASING amounts of food-stuffs, chemicals and mined products being shipped across the country, the railroad industry found the need for easily loaded, large covered hopper cars that keep materials safe, clean and dry during transportation.

To meet this need, Pullman-Standard Car Mfg. Co., Chicago, built a giant—the Super-Jumbo PS-2 with a 3,219-cu-ft capacity. The firm says the large car fulfills the wishes of lines who freight such bulk ladings.

In designing the large PS-2, company engineers looked for a fabrication method that would provide smooth, pocket-free inner walls so materials could not find a place to hide when being unloaded. The answer to the problem?—welding!

The engineers also looked for a method of keeping the cargo in, and dirt, water and weather out. The answer, again, welding.

Here's what welding has to do. It must help construct 63,300-lb freight cars, more than 47-ft long, 10½-ft high, and 13-ft wide, on a production line basis.

Each car has three covered hoppers. Their walls are made of 5/16-in. steel plate inside, and ⅜-in. plate outside. The hopper floors, sloped to provide gravity unloading through outlet gates at the bottom, are of 5/16-in. plate.

Supporting ends of the cars' exterior are made of one-piece pressed 3/16-in. steel plate. Steel used in fabricating the floors, frames, angles, sides and roofs include ⅛, ¼, ½, ¾ and 1-in. plate.

All steel is of an open-hearth copper-bearing variety specially made for Pullman-Standard to contain the ingredients needed for good welding.

All edges of parts are sheared along their entire length before joining. But, the ¾-in. front draft lug faces, the ½-in. center filler sole plates, and ½-in. center filler cross pieces are machine beveled.

Manual metal arc, semiautomatic and automatic submerged arc welding are used in car fabrication. Manual electrodes E6012 and E6020, 3/16 to 5/16-in. in diameter are used, as are 5/32 and 5/16-in. E6010 electrodes.

During semiautomatic welding, 5/64 and 3/32-in. mild steel wire is used with Lincoln 780 and 781 flux, and Linde 50 composition.

In fully automatic welding operations, high-tensile wire 5/32, 3/16 and 7/32-in. in diameter is used with the same fluxes plus a Lincoln 840 composition.

During automatic welding, the 5/32-in. wire is used at 675 amp, 28 volts; the 3/16-in. wire at 750 amp, 32 volts; the 7/32-in. wire at 900 amp, 36 volts. Welding speeds range from 32 to 96 ipm.

Three types of fully-automatic machines are used. One machine has two d-c heads, another an a-c and a d-c head, and the third is a four-headed unit, with two a-c and two d-c heads.

Most of the work done on the cars is positioned, permitting weldors to use 5/16-in. electrodes when manual welding. Power is drawn from transformers to provide 420 amp at 28 volts. Huge fixtures are used to rotate and turn cars over during fabrication so almost all welding can be done in down-hand position.

Motor generator sets are used when weldors must do vertical and overhead welding, or when they are tacking components in place.

In fabricating a single Super-Jumbo PS-2 car, 399 lb of manual electrodes, 135 lb of automatic wire and 159 lb of flux are used.

After each car is completed it is tested to be sure it can carry its lading and keep it dry and clean. To test the car, water is cascaded over the finished product. Then the car is checked inside for leaks. If any are found, they are repaired before the car is shipped.

The large cars have 10 loading hatches on the roof and six outlet traps underneath to facilitate loading and unloading. The hatches and outlets are specially constructed and all-welded so they cannot jar open enroute, and so they are leakproof.

Hoppers are constructed with smooth welded interior seams so commodities can filter out quickly, without leaving small particles behind. This makes the hoppers self-cleaning, since there are no voids or cracks in which matter can linger.

ABOVE, weldors tack roof sheets in position. At left, after sheets are positioned, an automatic, dual-head submerged arc unit joins sheets to carlins. Side plate seams are then automatically welded.

AT right, previously welded side units are hung upside down to permit down-hand welding of side stakes to underside of roof angle. At left, special turn-over jig has flipped car on side to permit down-hand welding. Jigs are used to permit such welding in as many instances as possible.

SPECIALLY designed automatic welding unit, at left, permits uniform welding of circular roof hatches. At right, inside view of hopper showing corner construction. Weld seams of side sheets and side sheet to side plates are shown. Welded construction permits clean, lap-free interior, important to gravity unloading of dry bulk commodities.

Resistance welding of aluminum alloys

by **J. F. Deffenbaugh**

The Federal Machine & Welder Co.

MOST RESISTANCE WELDING of aluminum alloys has been done by either spot or seam welding producing weld quality equal to, or better than, military standards.

Since welding techniques used by any one manufacturer are normally the result of his welding engineer's experience, there is some difference of opinion on the machine type and welding technique best suited for a particular welding operation.

For this reason, several types of machines have been developed. However, there is agreement on the techniques used for each type of machine. So it is not difficult to choose size or capacity of a machine for a definite welding job.

In commercial welding, on the other hand, usually the only welding specification to be met is minimum area of the fused zone. However, even this is not too critical since strength requirements of most commercial joints are not precisely known.

Add to this the fact that other factors not involving the machine (*e.g.*, material surface resistance) are not controlled, and the reason for so much conflicting data on commercial spot and seam welding of aluminum alloy is apparent.

Because of increased use of aluminum alloys in aircraft related fields, and because of substantial cost differences between three-phase and single-phase direct energy welders, considerable development has been done on schedules for single-phase machines.

Table 1 summarizes three published schedules and a fourth which cover only one alloy and gage. For comparison, frequency convertors and metallic rectifiers are included. Examination shows the differences in welding current magnitude, as well as time and force.

Calculated electrical energy transformed into thermal energy in the weld zone is shown for each schedule, as well as for 1010 steel, in figure 1. Although not extact, they do give comparative magnitudes.

Note in single-phase schedules there is a variation of 500% in energy and 400% in time. Without further analysis, it is difficult to decide which schedule is most desirable.

Mild steel welding techniques are a good basis for comparison with aluminum welding techniques.

If physical and electrical properties of 5052 aluminum are compared to the same properties of mild steel, some idea of energy and time differences for welding aluminum become evident. These properties for three alloys and mild steel are listed in figure 2.

Properties influencing energy and time requirements of 52SH38 alloy (5052) are: plastic range; thermal conductivity; mass; specific heat; welding current; surface resistance; welding machine application; machine losses; and control.

Average plastic range of aluminum is about half that of steel, so less heat energy is required to obtain that range, *i.e.*, it requires only half of the thermal energy. Because plastic range is only about 200 F (about 800 F less than for 1010 steel) heat energy variation to reach, but not exceed, the weld zone's plastic temperature is very small.

Thermal conductivity is measured by generated heat lost to surrounding mass. If generation time of heat energy in aluminum is the same as for mild steel, temperature rise is only one-third that of steel. Therefore,

SCHEDULE	FORCE (POUNDS)		UP-SLOPE		WELD		DOWN-SLOPE	
	WELD	FORGE	%I_W	T	I_W	T	%I_W	T
A 10	660	—	—	—	33000	8	—	—
B 10	600	—	30	4	25000	10	60	12
C 10	750	1700	32	2	22000	3	50	3
D 10	1050	—	—	—	30300	9	—	—
MR-30	900	2250	—	—	37000	4	81	4
FC-30	900	2300	—	—	46000	1	30	5
1010	650	—	—	—	10300	12	—	—

TABLE 1—Published welding schedules for 0.051-in. 5052 aluminum alloy, including 1010 steel, frequency convertors and metallic rectifiers.

SIZE	KVA	THROAT DEPTH	ELECTRODE FORCE	SECONDARY CURRENT
1	30	18	2250	17000
		24	1550	15000
		30	1000	15000
	50	18	2250	22000
		24	1550	19000
		30	1000	19000
	75	18	2250	27000
		24	1550	23000
		36	1000	23000
2	100	18	4000	31000
		24	3000	27000
		36	2250	27000
	150	18	4000	38000
		24	3000	34000
		36	2250	34000

TABLE 2—Resistance Welder Manufacturers Ass'n standards for press type spot welders. Values are guaranteed minimum, plus or minus 10%.

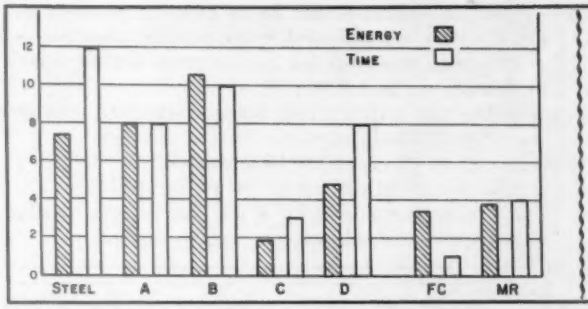


FIGURE 1—Weld energy and heat time for 0.051-in. 5052 aluminum alloy. Energy is in watt seconds x 10^2 and heat time is in cycles.

Material	Plastic Range (°F)	Conductivity Electrical (% Cu)	Conductivity Thermal (CGS)	Mass (Units)	Specific Heat (Cal/g)	Tensile Strength (psi)
2S-O	1190 1125	59	0.53	1	0.23	13000
52SIH38	1100 1200	35	0.33	1	0.23	41000
75ST-6	890 1190	30	0.29	1	0.22	72000
1010	1700 2700	10	0.10	3	0.11	72000

FIGURE 2—Properties and characteristics of three aluminum alloys and 1010 steel for comparison.

in order to maintain efficiency, the time of welding current flow must be one-third that of steel.

The same applies to mass. Aluminum's mass is one-third of steel's; thus requiring heat energy one-third less than steel to raise it to the same temperature.

Mass and specific heat determine heat energy necessary to increase a substance's temperature to a specified temperature.

Energy required to raise a given volume of aluminum one degree is twice that of steel because of aluminum's specific heat and one-third because of its mass.

The product of the two effects is two-thirds, *i.e.*, for equal volumes, two-thirds as much heat energy is required to raise aluminum one degree in temperature as is required for steel.

However, since plastic temperature of aluminum is only one-half that for steel, net energy requirement is one-half of two-thirds, or one-third. The ideal schedule should then develop thermal energy equal to one-third the energy required for steel, and with a weld heat time of one-third.

Thus, all other things being equal, the same power is required. Aluminum and steel welding currents will be equal if effective resistances are equal.

Evaluation of this resistance, however, is difficult since it depends primarily on surface resistance rather than parent metal resistance.

Resistance of the quickly-formed oxide film on aluminum varies widely and can be nearly any value up to a maximum of about 700 microhms.

Minimum value is obtained by removal of the film with a fine bristle stainless wire brush. This does not, however, lend itself readily to large parts and chemical removal is then used. When an optimum chemical cleaning method is employed, surface resistance can be held between 10 and 50 microhms easily.

Since it is desirable to reduce electrical power requirements to a minimum, it would seem logical to prepare the material so surface resistance is as high as possible. This is true only in theory.

No method has been developed to produce a high surface resistance not critical in application, and to give a uniform resistance over the entire part. Large variations in surface resistance will also produce large variations in heat energy and cause prohibitively great variations in nugget size.

In this comparison, a welding machine having a maximum force of at least 1,700 lb and a maximum welding current of at least 22,000 amp is required. Assuming two pieces of 0.051-in. 5052 alloy is the maximum to be welded, the minimum size machine available is Size 1, 75 kva with an 18-in. throat.

(Table 2 is part of RWMA standards for resistance welders. Values shown are guaranteed minimums, ±10%, for the machine sizes listed.)

Frequently part geometry is such that an 18-in. throat depth is not deep enough. If the part required 36 in., a Size 2, 100 kva welder would be required.

Economically the smallest size and kva capacity welder meeting the schedule requirements should be chosen. It is also desirable to use one with as short a throat as possible because of increased electrical reactive losses which increase with throat depth.

Vector diagrams of the losses of the two machines selected as having necessary force and welding current are shown in figure 3.

Note that reactive (KVAR) loss of the 36-in. throat machine is 28% greater than the 18-in. type. This increases the electrical welding demand and, all other things being equal, would require a greater capacity power supply system.

Power loss in the weld zone is not shown, since it is only about 2 kw. In the case of the Size 1 machine, this gives an efficiency of 1.5% and emphasizes the fact that the greatest portion of power and energy losses are in the welder.

Careful consideration should be given to the type purchased, since power used is a function of its characteristics, and not power required for the weld.

Reactive power may be reduced to nearly zero by applying series capacitors to single-phase, direct energy

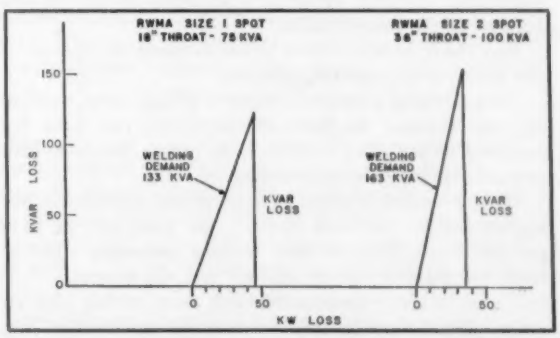


FIGURE 3—Vector diagrams of the two machines meeting welding requirements show welding demand and KVAR losses.

machines, or by using a frequency covertor or metallic rectifier machine.

As seen in Table 1, schedule "C", the machine and control must provide forge-force, up-slope time and current, weld time and current, and down-slope time and current.

The control standards (required for aluminum welding) are based on synchronous precision combinations having precise timing. Less expensive, non-synchronous controls can be used for welding mild steel.

An idealized plot of temperature rise of mild steel weld zone as it varies with time is shown in figure 4. If optimum value of 10,000 amp weld current is used, time can be varied ± 3 cycles from the optimum weld heat time of 12 cycles without increasing or decreasing thermal energy too much. Likewise, the current can be varied $+10\%$ and -12%.

Figure 5 shows the same variable for aluminum. Here allowable time variation is only ± 0.2 cycles and the allowable current variation only $\pm 5\%$, because of the narrower plastic range. Both plastic ranges are shown in figure 6 to emphasize the difference.

Only factors effecting nugget and welder have been considered so far. There are, however, other effects often making aluminum alloy welding difficult.

One is aluminum's tendency to alloy or adhere to the electrode, generally because of aluminum's surface temperature increasing to near melting over the electrode contact area.

(This can be a result of excessive thermal energy generation at the surface, or in the weld zone, or it can be caused by actual mechanical adherence due to rough and pitted surfaces.)

Excessive pick-up must be prevented, and normally the best solutions are internally water-cooled wheels, low surface resistance, and low energy schedules.

A second consideration is the electrode's ability to maintain contact with a required force. Since aluminum's temperature increase rate is high, there is rapid strength decrease at the weld zone. Electrodes must move together a small amount to maintain the existing force.

Although this movement is small, time is extremely short and the required acceleration and velocity can only be obtained by minimizing the moving mass' inertia and friction.

Up- and down-slope time and current slows the rate of initial heating and final cooling in the weld zone, producing the same effect as a decrease in inertia and friction of the force system.

The third consideration is the contour or radius of the electrode's contacting surface.

Since welding aluminum requires a high value welding current, existing machines normally do not have the required output. One solution is to reduce electrode contact area to increase current density.

With a smaller contact area, however, unit forces are higher and the electrode deforms the work surface to a greater depth. This in turn reduces unmelted material thickness between the tip surface and the nugget.

Higher surface temperature and more severe pick-up are produced, thus the solution is really undesirable. Too small a tip or wheel radius also causes indentation, another unwanted result.

Electrode radius should be as great as possible, and not less than recommended in the welding schedule.

In general, the rules for spot or seam welding aluminum alloys are as follows:

1. Use high current, high forces, short time, and low energy weld schedules.
2. Use synchronous precision control.
3. Use material cleaned to low surface resistance.
4. Choose a welder with a low inertia, low friction force system, and adequate secondary current.

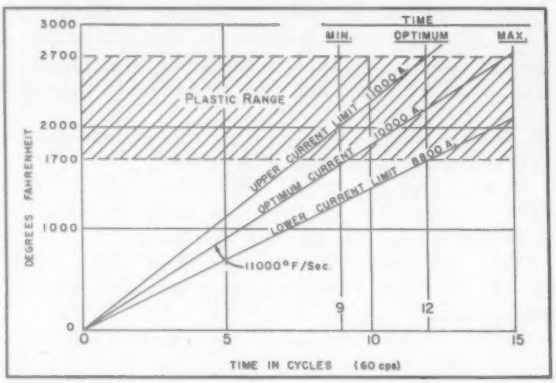


FIGURE 4—Idealized plot of temperature rise of mild steel weld zone as it varies with time. Steel is low carbon, 18 gage.

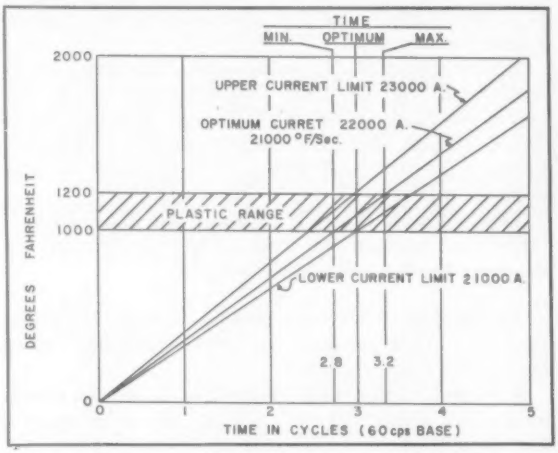


FIGURE 5—Idealized plot of temperature rise of aluminum alloy weld zone as it varies with time. Alloy is also 18 gage.

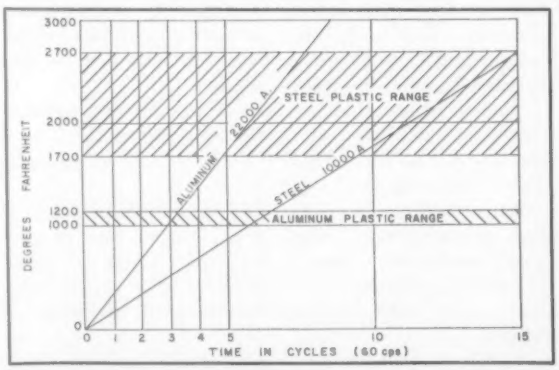
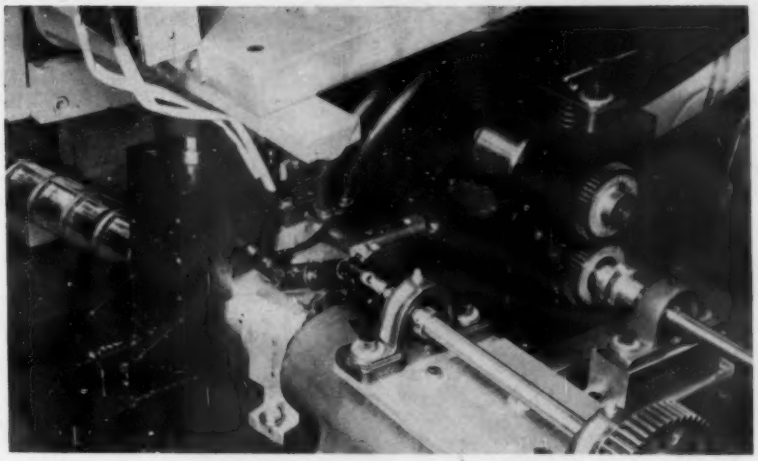
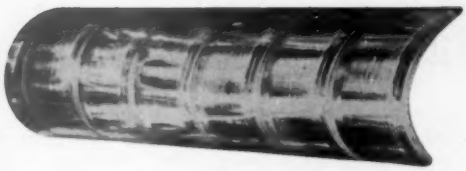


FIGURE 6—Plastic ranges for both low carbon steel and aluminum alloy are compared in this one chart to emphasize the difference.



STRIP metal (at right) is drawn into the mill by a motor-driven mechanism. Forming rolls shape the metal into spirals of pre-set diameter and the open seam is then joined by the high-frequency resistance welder. Result (at left) is economical, stronger spiral tubing.



Spiral-welded tubing offers strength, efficiency and economy

A HIGH-FREQUENCY resistance welding unit and an electronic mill have been combined by New Rochelle Tool Corp., New Rochelle, N. Y., to produce spiral-welded tubing at high speeds in diameters ranging from 1½ in. to 10 ft or more.

The main advantage of spiral-welded tubes is the increased strength obtained with each additional spiral per running foot.

Because of this added stiffness and strength, tube diameters can be varied, lightweight metals can be used, and wall thicknesses can be substantially reduced, (with subsequent savings being realized).

Occupying a compact 48 sq ft as compared to the longer 40 ft or more needed for standard tube-forming mills, this mill is powered by a 60 kw high frequency generator, and is mounted on a raised platform.

A motor-driven mechanism draws strip metal into the mill, moves it through the forming rolls for its spiral shape and desired diameter, and then delivers the formed open seam to the welding head.

Strip metal in a coil is spindled on a stand at the end of the mill, where it enters at a pre-set angle. (The easily adjusted angle determines the number of spirals to be produced in each foot of tubing.)

As the strip is coiled in the mill, it produces an elongated "V." The weld is then made at the V-root after high frequency current is introduced into the metal by two sliding contacts, one on either side of the open seam.

This high frequency resistance seam welder, developed and patented by the New York firm, makes use of high reversing current, *i.e.*, 450,000 cycles per minute versus normal line frequencies of 60 cycles.

Instead of following the direct low-resistance path, current takes the long low-inductance route. Each side of the V-groove acts as a return conductor, and the current flows on the two surfaces to be welded. The two contacts ride about one or two inches from the V-root.

The high frequency current hugs the opposite edges, and localized high-intensity heat brings root edges to welding temperature. Pressure is then applied to produce either a lap, mashed-lap or butt-edge weld.

Presently 1½-in. diameter tubing is the minimum size produced on the combined mill-welder unit since a mandrel must be introduced inside the tube to obtain a mashed-lap weld. The company's experience has shown this type weld to be the most effective. Difference in wall thickness at the weld point is negligible.

According to the firm, both ferrous and non-ferrous metals can be joined using this process, including aluminum, copper with 100% conductivity, and the rarer metals such as zirconium. Material ranging from 0.004 to ⅜-in. thick can be welded. Developments are now underway for production of smaller diameter tubing than the 1½-in. minimum.

Another advantage of the welding unit is its high speed production, *e.g.*, 1,000 ft per minute longitudinally with 0.004-in. metal, and 150 ft or more per minute of 3-in.-diameter tubing using tin plate stock. (By increasing the power supply, welding speeds can be increased.)

Down time to start a new coil, or to change or adjust diameters and number of spirals, is just a few minutes. Welding contacts, with a service life of approximately 100,000 ft of weld, can be changed in five or six minutes.

Tube manufacturers may find new efficiency and economy in this new, compact spiral welder.

ONE method of inspection is magnetic particle. Here, an operator applies the prod where arc marks are not objectionable.

by **H. B. Norris**
Allis-Chalmers Mfg. Co.

An introduction to non-destructive testing of welds

NON-DESTRUCTIVE TESTING is a rapidly expanding field, and industries whose products are susceptible to failure or require high operating reliability, (*e.g.*, power generating equipment, aircraft) use almost the full range of these tests.

(For the purposes of this article, application and effectiveness are related to one product field, in this case, steam turbine generator components.)

Non-destructive testing is self-explanatory, *i.e.*, any soundness test which does not destroy or alter the material being tested. In order of complexity and cost, these tests are classed in six groups: leak, proof, liquid penetrant, magnetic particle, radiographic and ultrasonic.

Products which must contain liquid or gas are given a leak test. In a hydrostatic test, the item is filled with water or oil. Pressure is applied either by the liquid's weight alone or with additional pump-supplied pressure.

Gas, such as nitrogen, can also be used. However, because of the explosive hazards, extra precautions and equipment are advisable. Gas leakage is detected by means of a soap-solution coating, which bubbles at any leakage areas.

A mixture of air and ammonia gas can also be used. Leaks are then detected with a weak solution of muriatic acid. A third method is to fill the container with gas and use a mass spectrometer.

Testing under conditions exceeding any possible operating conditions is called a proof test. It is non-destructive only for sound material, since defective material fails and is destroyed. This testing method can be applied to any operating condition, *e.g.*, overspeeding of rotating machine parts. Safety precautions in case of failure are necessary, of course.

(Special equipment to record stress and balance information is often used with the overspeed test. Frequently the oversped part is also given an X-ray, ultrasonic or magnetic particle test in order to detect any growth of flaws.)

A third type of non-destructive testing uses liquids which, by means of capillary action, penetrate fissures and openings in metals.

Liquid is applied to the material's surface, and after a time interval (up to an hour) is removed. Any liquid held in the fissures then bleeds out. Using a colored dye or a fluorescent liquid under black light, the bleed-back is easily observed.

This test is especially applicable to non-magnetic materials which cannot be easily tested with magnetic particle or radiograph.

Breaks or gaps at or near the surface of ferro-magnetic material can be detected with the magnetic particle test. Proper magnetization will produce poles at the locations of any breaks or gaps.

Magnetic particles applied at these locations will take the shape of the break or gap. The part can be magnetized either by passing a low-voltage, high-amp current through it, or by positioning it properly in a strong magnetic field.

The particles are flowed across the part being inspected either suspended in air current or in a liquid carrier,

TRANSDUCER is held against the revolving part while an ultrasonic wave pattern appears on the reflectoscope screen.

and are colored or fluorescent for easy observation.

Gamma ray and X-ray are used to see the internal soundness structure of metal castings, weldments and forgings. The radiation produced is allowed to penetrate the object being examined and is recorded or observed on photographic film or a fluorescent screen.

The image is in a shadow form since penetration intensity varies with the metal's section and soundness. Type of radiation used is determined by several factors, including the analysis and thickness of metal, in addition to the economics involved.

Gamma radiation from radio-isotopes is generally less expensive than X-ray producing equipment. However, there are other factors which may make it more economical to use X-ray. These include the number of radiographs to be made in a set time interval, thickness of material to be radiographed, and the availability of electric power.

Defects which can be found must be a minimum size in relation to overall thickness, usually expressed as a percentage of the total thickness. Porosity, slag inclusions, lack of penetration and cracks are the defects commonly found.

The most recent testing method to join the non-destructive grouping is ultrasonics or sound wave.

Reflections or echoes of the sound take place on the outer metal face and the inner faces of defects. These are analyzed by electronic means and the presence and position of the defects can be determined. The same equipment used to produce the sound is used to analyze the reflection.

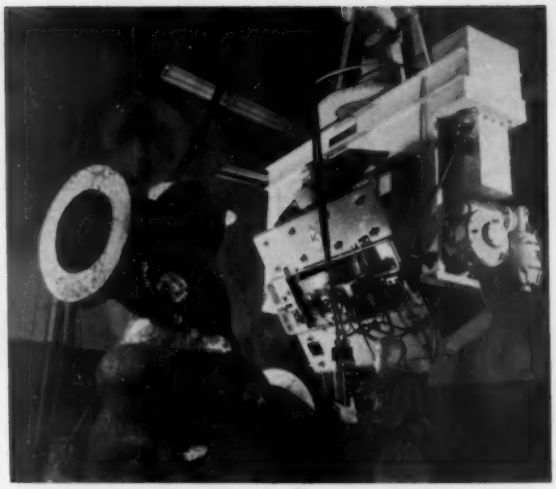
A crystal, vibrated at high frequencies while in contact with the part, transmits the sound wave. It then receives the echoes and converts them into electrical impulses.

Ultrasonic testing is limited by the ability of the metal structure to transmit sound waves and reflect them so that changes due to defects can be determined. Grain size and geometry are actually the determining factors.

Examples from turbine and generator components can be used to relate these testing methods to actual applications on welds and weldments. Each component is examined by one or more of the six non-destructive testing methods.

Steam and oil carrying turbine pipes must not only be leak-proof, but must have no defects leading to ultimate failure. Therefore, welds between adjacent sections of pipes receive a leak test with water under pressure, a magnetic particle test, radiograph inspection, and frequently an ultrasonic test.

EXTERNAL coil is used to create a magnetic field for magnetic particle testing when finished surfaces can not have arc or burn marks from a prod.



FASTEST method of X-ray inspection is this 24 million volt betatron. Rays pass through the part and impinge against film behind. Image shows location of flaws, sand holes and other undesirable conditions.

Turbine cylinders are generally subject to stresses from high-temperature, high-pressure steam, and are often fabricated of low-alloy metal. Use of this material increases welding problems and the number of tests used to prove weld soundness. Welds are subjected to hydrostatic tests, and in a majority of cases, to magnetic particle and radiographic inspection.

Valves operating under the same conditions as the cylinders receive the same tests. Hardfaced valves, however, must have no fissures or pinholes in the finished surface to prevent leakage across the valve seat face.

Since radiography might not detect the defect's size (which is important) and the metal deposit is non-magnetic, both radiography and magnetic particle are ruled out. In this case a penetrant test is used at various stages of manufacture.

Turbine castings often required repair welding. To ensure repair soundness, the area is checked by magnetic particle and radiographic tests. The entire casting, including the repaired area, is also hydrostatically tested.

Among the generator components are the rotor fans (cylindrical hubs fitting over rotor shaft ends with formed steel plates welded for blades). Being subject to fatigue, defective welds between hub and blades could result in failure and considerable damage to the generator.

Welds are subjected to several magnetic particle tests during fabrication and heat treatment. The fan is also given a proof test by rotating it at speeds above those used in normal service, after which another magnetic particle test is run.

Although not operating under fatigue or high-stress conditions, strator weldments must have sound welds so that electro-magnetic characteristics of the steel are uniform across the welded joint. Radiographic inspections are run quickly and easily during early fabrication stages.

As can be seen, one or more non-destructive tests are applied to welded components in a single product. The various testing methods complement each other and should be applied as each situation demands.

WITH THE AWS . . .

ONE unusual display at the annual welding show was Cambridge Corp.'s liquid oxygen truck (at right) featuring an all-aluminum vacuum-jacketed tank with a reinforced plastic cab and body trim. Other pictures on this page show some of the numerous manufacturers' exhibits seen during the three-day show by 11,241 registrants at Chicago's Amphitheatre.

IN the evening of the first convention day, the President's reception was held so AWS convention delegates could have an opportunity of meeting newly-elected president C. I. MacGuffie of Air Reduction Sales Co. Jim Alcock (left) of Saginaw Welding Supply Co., Saginaw, Mich., chats wth Mr. and Mrs. Ray Townsend. Townsend is president of Tweco Products Co., Wichita, Kan. Seen in the background is John Matasovic of Oxo Equipment Co., New Lenox, Ill.

Among those attending president's reception was a group representing Arcos Corp. Left to right: Mrs. A. G. Craske; C. M. Cito of Arcos Brussels, Brussels, Belgium; Mrs. R. D. Thomas, Sr.; and Mr. Thomas. In photo at right are The Tonettes, a musical trio.

. . . IN CHICAGO

TOURING the convention and welding show were members of the Small Business Welding Specialists study team from Japan. The group was on a nationwide tour under the auspices of the International Cooperative Administration, Washington, D.C. Here W. D. Kinsey, tour leader, calls attention to a point of interest in the AWS program.

TWO midwest distributors were honored by Worthington Corp., Harrison, N.J., for their 15 years of service to the company. From left to right, Bob Kohlbry of Machinery & Welder Corp., Chicago; Paul Galton of Worthington; and Ray Tarbell of Scott-Tarbell, Cleveland. Awards were given at a special luncheon held at the Amphitheatre. (The 10 AWS national and 15 regional awards presented at the convention's opening session were detailed in WE, May, p. 7.)

The author's experience and extensive testing uphold the German contention that

Good mechanical properties can be obtained easily when Tig welding titanium

By Helmut van Kann
Fried, Krupp Titanium Div.
Essen, West Germany

UNDER NEARLY the same conditions as with other materials Tig welding can also be used for titanium welding. Only a small change in welding conditions and equipment are required to obtain good mechanical properties equal to those of other metals.

Since there is no large titanium-consuming aircraft industry in Germany, titanium welding experience comes mainly from other industries. Parts to be welded vary in size; therefore, an argon filled welding chamber cannot be used. Only a few similar apparatus parts have to be manufactured, so expensive jigs and fixtures also are ruled out.

Unalloyed titanium is still required because of its corrosion resistance, but its high cost necessitates sheet-lined containers, which results in many welds in titanium.

Titanium Sheet Welding

High reactivity is the main problem in handling molten titanium and, generally, Tig shields will protect weld zones from air. Although the usual torch-nozzle may be used, it must have a larger diameter and higher weld speed and current.

Another difficulty is protection of the weld's underside from air. A copper backup bar or plate will give good results. Although usable on small parts only, a groove with a stream of argon directed below the bead of a gastight argon chamber can also be used.

Sheet surfaces should be cleaned just prior to welding. Titanium will dissolve its own oxide. If scaled surfaces are joined, the oxygen will form lower oxides, causing serious embrittlement. Even fingerprints cause some weld brittleness.

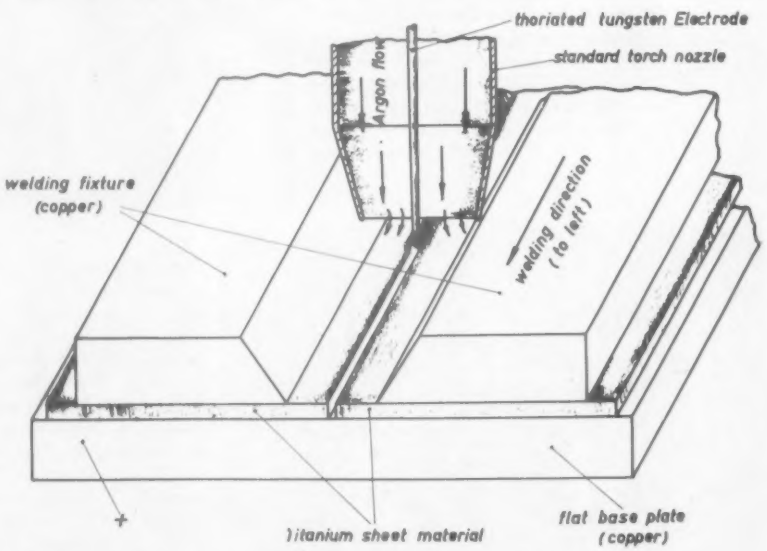
When Tig welding titanium, use of filler metal should be avoided whenever possible for two reasons: *(1)* filler wire causes a turbulent stream in the gas shield, contaminating the argon with air, and *(2)* because of the weldor's hand movements, it is impossible to always keep filler wire within the gas shield without introducing contaminating air. Wire will scale very quickly upon leaving the gas shield and if dissolved in the weld pool, causes brittle areas. This second point can be eliminated by using an automatic filler feed, but the troubles caused by the turbulent stream along the wire are not eliminated by automatic feeding.

If filler material is required, a small foil between the sheets is technically and economically sound. Depending on foil dimensions, each desired weld form can be produced. Natural helium sources are not available in Germany, so a 99.9% pure argon is used.

Preparation And Tests

At first unsatisfactory results were obtained with this argon. Results are mentioned as a point of interest in titanium welding.

A gas container filled with a pressure of 2,850 psi had a dew point of —57 F. As the work progressed, the dew point increased with the decreasing pressure in the gas container. It was found that at a pressure of 215 psi the dew point had reached —42 F, showing that the



SCHEMATIC view of a welding fixture for flat sections of titanium.

water content of the gas had nearly doubled. This can be explained without difficulty. . .

Gas Moisture

With the high pressure, the higher equilibrium pressure prevents the water content in the container from evaporating, but with decreasing pressure an increasing amount of the moisture evaporates and contaminates the shielding gas. This results in oxygen and hydrogen contamination and increasing hardness and brittleness of the weld.

Samples were joined with the usually required precautions for titanium welding. The unalloyed titanium used met requirements of Aeronautical Material Specification 4900 and is comparable to A55, RS55, Ti65A or MST grade III in the United States. The sheet was hot and cold rolled to a thickness of 1/16 in., then annealed ½-hour at 1,200 F in a high vacuum furnace.

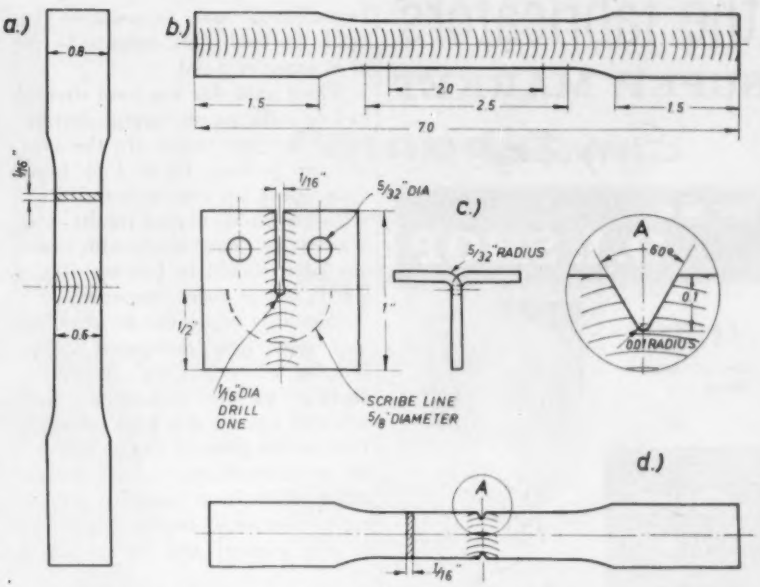
Mechanical properties of the material and the best welding conditions (with a minimum of special equipment) are shown in the tables.

Tensile Tests

Different tests were made with weld specimens. The first was to find the influence of the rolling direction of the sheet with the welding direction transverse to the stress direction. With these tests, only a little can be said about the absolute mechanical values of the weld, especially when the break occurs in the base materials.

Welding conditions for preparing samples of commercially pure titanium.

Current	160 amp d-c
Electrode	Thoriated tungsten, straight polarity
El. diameter	1/16 in.
Voltage	11.5 volts
Arc-length	⅛ in.
Welding speed	5 p
Welding direction	to left
Argon flow	16 cu ft/hr
Torch-nozzle	⅜ in. diam.
Argon purity	99.98%



SPECIMENS for testing weld joints on titanium sheets.

In each sample the break occurs in the non heat-affected material, loaded transversely to the rolling direction, while in specimens loaded in rolling direction, the break occurs in the weld. The tests show that the unalloyed titanium can reach a tensile efficiency of the weld of 0.95 to 1.0, if good welding conditions are chosen.

Ductility (elongation and reduction in area as a measure) decreased to perhaps 70 to 80% of the base metal. Since range of measurement includes the weld as well as heat affected and unaffected zones of base metal, results have only a limited value. Better results are obtained with test pieces having a longitudinal weld.

In testing these, the whole weld and heat-affected zone has to be elongated. Width of the whole sample was 0.6-in. with a weld of perhaps 0.4 to 0.5 in., so that the whole specimen width was highly heat-affected.

Bend Ductility

The tensile stress of the weld area compared with base material also was not noticeably affected in these tests. Ductility was again reduced to about 70%. In spite of this decrease, weld values are still meeting different specification requirements of several American and foreign institutes for unwelded material. Ductility loss cannot be due to any embrittlement. As shown later, it is only an effect of grain growth through high heat input during welding.

Many bending tests were made in the weld direction as well as perpendicular to it. Samples were bent in both directions to test bend ductility of upper and lower weld surfaces. With a bending radius of 0.16 by sheet thickness and a bend angle of 105 deg, the unwelded material shows the first small break. This occurs with nearly all welded specimens with a bending radius of 0.5 by sheet thickness, showing small loss in bend ductility. The break in the welded samples always occurs between the big grains, usually stops, and another break occurs between two other grains. Bending of the coarse-grained weld audibly caused formation of twin-crystals, a phenomena well known in metallurgy as "tincry."

Generally, test results show highest decrease of the bending radius occurs in the weld's underside in the outer surface of the bend. All welded specimens also meet specifications for base materials of 1.5 times the sheet thickness.

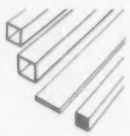
Final Testing

To determine the weld's cupping ability, deep drawing tests were made. As in the bending tests, half of the samples had the outer fiber of the cup in the weld. The other half were in the weld's underside. The break in all specimens occurred in the

the fabricators
SUPER MARKET
Everything
for the O. I. SHOP

CASTINGS
Over 400 designs to choose from.

TUBING
From one tube to a mill lot.



STAMPINGS
A wide range of styles and shapes.

PRIMERS AND FINISHES
Specially designed for O. I. use.

GARDEN FURNITURE
Great traffic and profit builders, many styles to choose from.

MACHINE TOOLS AND SUPPLIES
Everything your shop would need.

TFC

Orders shipped same day, by air if requested.
WRITE FOR OUR **NEW CATALOG**
over **400** *Casting Designs*
TENNESSEE FABRICATING CO.
1420 Grimes Street
Memphis, Tennessee
Send your new 48-page Catalog.
Name_____ Company_____
Address_____
City_____ State_____

heat-affected zone immediately beneath the weld. This seems to be the most sensitive point.

Which weld side was most stressed had no influence on cupping ductility value. Average values are the same and are perhaps 10 to 15% lower than values for base material. Even with such good cupping results, deep drawing test temperature with titanium joints should be between 400 to 800 F, not at room temperature.

Since it is impossible to make impact tests with thin-gaged sheets, Douglas Aircraft Corp. has introduced a "tear-test" to determine weld behavior against this kind of stress. The tear test gives an empirical measure of susceptibility to crack propagation. Material is classified according to manner of tearing (gradually or with a snap) and load at which tearing crosses the sample middle.

Good material has to indicate a slow, gradual tear. Both unwelded and welded material did this, showing tear resistance had not suffered from welding and grain coarsening. No difference was noticeable in the manner of tear with respect to rolling direction. Both welded and base material met load requirements for this test.

Notched Weld Behavior

Weld behavior in the notch tensile test was then examined. The test showed ability of the material to yield locally in the notch area and to redistribute stress so higher loads can be applied than in unnotched tensile specimens before fracture occurs.

To determine this ability, a number of specimens was made from base and welded material, the latter with the notch in the weld middle. Average values of these tests compared with unnotched specimens show the weld's notch sensitivity is only affected slightly. The tests showed again that titanium welds made with required precautions are not appreciably reduced in mechanical properties compared to base material.

To determine which joint part suffered most under heat input, a study was made to discover how much heat affects the zones under the weld itself. The sheet's weld edges were marked with thermocolor-pencils before welding.

The important heat-affected zone is relatively small—about 0.025 in. from the weld. It can only be expected in this region, which is heated to a temperature 1,550 to 1,650 F for commercially pure titanium.

Mechanical properties of commercially pure titanium sheet.

	Rolling Direction					
	Long.			Trans.		
	Max.	Min.	Av.	Max.	Min.	Av.
Tensile strength (1,000 psi)	70	67	68	73	70	72
Yield strength (1,000 psi)	53	51	52	60	58	59
Elongation 1 in. %	44	41	43	47	45	46
Elongation 2 in. %	30	27	28	32	28	29
Reduction in area %	60	57	58	66	62	65

By means of notch tensile tests with the notches at different distances from the weld, it has been found that the most sensitive range of the joint lies between 0.00 and 0.01 in. beneath the weld.

Corrosion Behavior

To complete the survey, with welds consisting of good mechanical properties, there is no trouble with decrease of corrosion resistance in such reagents where titanium has proved successful. This is clear because there is no dependence in titanium between structural constitution and corrosion behavior as with stainless steel. Only with poor welds in titanium, seriously contaminated with oxygen or nitrogen, may trouble result with corrosion resistance. And this is due to its alloying with these gases during welding.

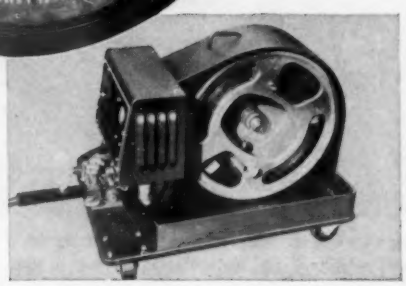
"Stoody SEMI-AUTOMATIC Hard-Facing *Splits my work in half!"*

Here's a welder's own words about semi-automatic hard-facing on roll crushers..."I can do as much work in 4 hours with Stoody Semi-Automatic Hard-Facing as I used to do manually in 8 hours. The metal doesn't get as hot, and I can make a higher, wider, bead —with less effort. You just can't beat these machines for hard-facing no matter how hard you try."

If you want to cut down on your own work, if you want to *accomplish more* in a given time, you should try Stoody Semi-Automatic Hard-Facing!

We'll be glad to arrange a free demonstration in your plant, hard-facing *your* parts. You be the judge!

Stoody semi-automatic wires are supplied in continuous coils and can be fed through most standard types of semi-automatic welding machines. A wide variety of alloy types cover all job requirements.



Literature is available.
Ask your nearest Stoody Dealer or write direct to the company.

STOODY COMPANY
11984 East Slauson Avenue • Whittier, California

Giant derrick parts are welded on a king-size jig

By R. L. Looney
District Engineer
Lincoln Electric Co.
Tulsa, Oklahoma

ALTHOUGH IT LOOKS like an outsize extension of a child's building set, the portable erection derrick above hoists 200-ton loads as easily as its miniature version lifts a toy block.

Built for John F. Beasley Construction Co., the derrick's substructure is of submerged-arc welded, T-1 steel girders. There are ten of these high-strength girders: four 80 ft long; two 76 ft 8 in. long; and four 13 ft long.

The 80-ft beams have webs 1¼ in. thick and 62 in. wide with flanges 2 in. thick and 16 in. wide. Two beams have cover plates, 1 in. by 18 in.

The 76 ft 8 in. beams are haunched. Webs are 1 in. thick and 39 in. wide at the center and 66 in. wide at the ends. Flanges are 12½ in. by 1 in. and have 14 in. by 1-in. cover plates.

The 13-ft diaphragms are similar to the 80-ft beams, except for their shorter length.

The largest beams weigh about 540 lb per foot of length. If fabricated from standard ASTM A-7 steel, instead of T-1, the necessarily thicker beams of equal length would weigh about 1,080 lb per ft. This 50% weight economy saves the firm a great deal in freight charges each time the rig must be shifted to another job site.

To ease the welding of such a large unit, the fabricator built a special jig. Spaced side-by-side, but on 5-ft centers, 17 beams with 14-in. flanges formed a bed 20 ft wide and 80 ft long. Bolted to the top of these beams were triangular kickers which were clamped against the flanges of the 80-ft beams to be welded.

Short sections of 8-in. beams rested on the jig to support the girder's web sections. As soon as all plates required for any one beam were located, the jig was sheltered from foul weather with a tarpaulin-covered skeleton frame.

Flange edges were prepared for welding by flame-beveling on both sides. But setting up the girders for welding was exacting work—specifications allowed a maximum 3/16 in. tolerance in the entire 80 ft length.

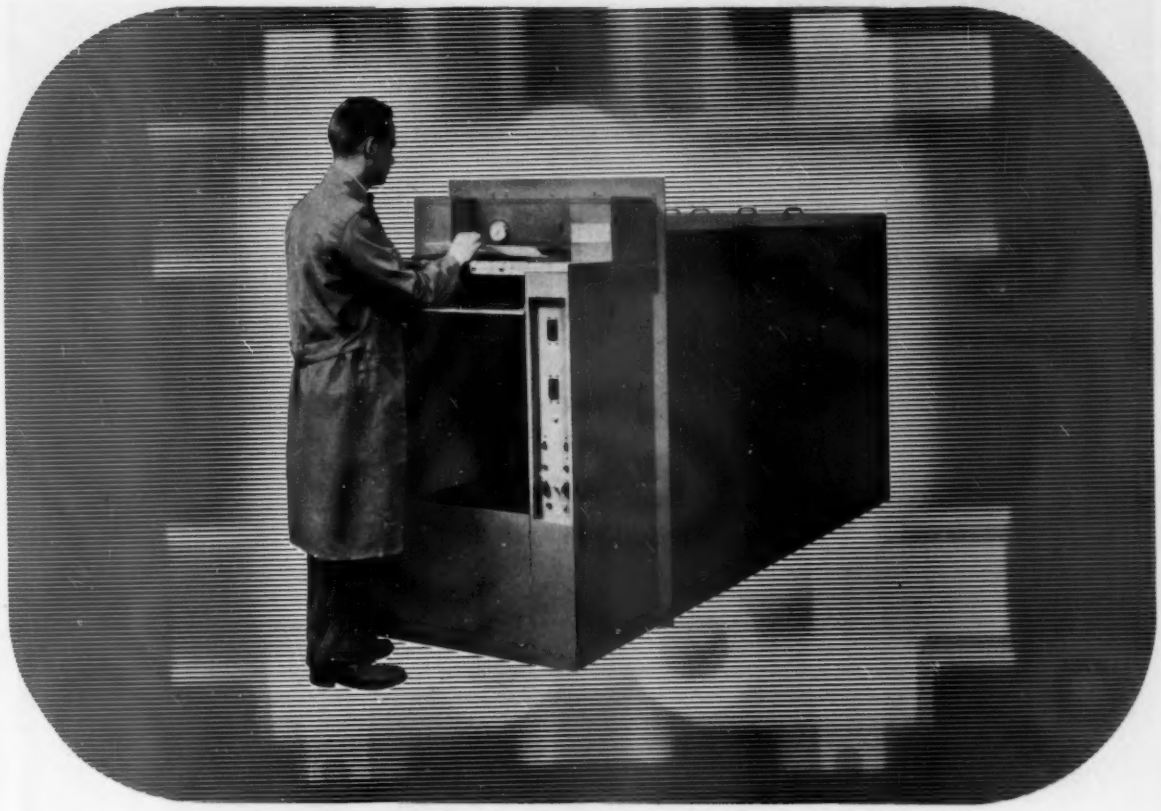
Before tack welding the parts, fitters carefully checked all dimensions. Distortion was sure to occur, they knew, and especially from such long welds. To compensate for this, flanges were tilted so their top edges were ⅜ in. off perpendicular. During welding, the flanges were pulled into line.

The first pass—in the root of the web-to-flange joint—was laid with a 70,000-psi tensile, low-hydrogen electrode. Thereafter, all welding was done with a semiautomatic welder.

Moving ahead of the welder, a large torch preheated the joint to about 200 F. The flux hopper—filled with a specially prepared flux—rode a small tractor. Following the operator was his helper, who retrieved the unfused flux with a vacuum recovery unit. A 5/64-in. mild-steel electrode, commonly employed for general fabrication, also was used on the T-1.

To obtain weld metal properties similar to those of T-1, the flux supplier compounded a special mixture

CURTAIN going up on welding. Welders work on giant derrick's substructure, part of which rests on specially-designed jig. Note clamps holding kickers.



13-minute industrial x-ray film processing

New Kodak Industrial X-Omat Processor can save you time and money

Kodak offers you automation in film processing—radiographs of uniform high quality, dry and ready to read in 13 minutes.

Film hangers are eliminated. Exposed films are merely removed from the film exposure holders and fed directly into the processor. Kodak Industrial X-ray Film, Type AA and Type M—sheet films or continuous lengths from 70mm to 17 inches wide—go through the system at 38 inches per minute. *And* only 22 inches of the unit's 10-foot 10-inch length need extend into the darkroom itself.

The Kodak X-Omat Processing System saves time and cuts costs. You'll want the complete story.

Send for the folder that gives all the details.

X-ray Division—EASTMAN KODAK COMPANY—Rochester 4, N.Y.

Use this coupon NOW for more information

EASTMAN KODAK COMPANY, X-ray Division, Rochester 4, N. Y.

☐ Send the folder about the Kodak Industrial X-Omat Processor.

☐ Send the names of the Kodak Industrial X-Omat Processor dealers in my area.

60-6

Name_____

Firm Name_____

Firm Address (Street)_____

(City)_____ (State)_____

Kodak

Shield them with economical barriers of J-M ALUMINIZED Asbestos Cloth

Radiant heat is a major cause of discomfort and fatigue that reduces efficiency and causes accidents. Economical new J-M *Aluminized* Asbestos Cloth reflects 90% of all radiant heat . . . helps maintain high production and good safety practices.

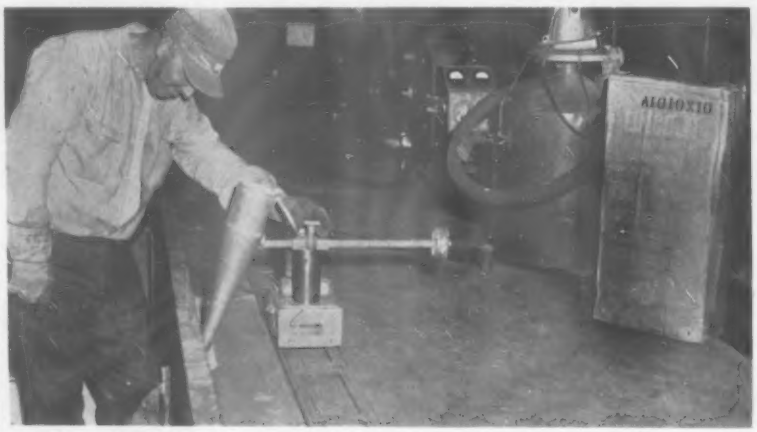
This new J-M material is a rigidly tested combination of aluminum and Asbestos. It retains a great degree of strength at temperatures up to 1400°F —over long periods of time—and can be used for curtains, shields, blankets, hoods and covers to protect workers from flame as well as radiant heat.

For further data, write Johns-Manville, Box 14, New York 16, N. Y. Ask for Brochure TX-2A.

PORTABLE SHIELDS for emergency jobs near heat or flame can also be made with this J-M *Aluminized* Asbestos Cloth.

JM JOHNS-MANVILLE

". . . JOINTS were preheated to about 200 F before welding." Doing the job is a large tractor-mounted heating torch. When welding begins, a helper will follow the operator, reclaiming valuable, unfused flux.



USING "prescription" flux containing alloys necessary for desired properties in weld. Machine is semiautomatic welder with mild-steel wire.

for the job. Its ingredients contained all the alloys necessary to gain desired properties. As welding was carried on, these alloys melted in the arc and blended with the weld metal. But joining techniques had to be closely controlled in order to dissolve a proper amount of flux and so yield the precise amount of alloy to the weld.

Using welding speeds of 10 to 14 ipm, five passes were made on each web-to-flange joint and both ends of the web were completely welded before turning over the unit. But welding warped the flanges so much that they not only absorbed the permissible ⅜ in., but travelled ¼ in. in the opposite direction.

This created no difficulty, however; after the girder was turned and five more passes were made, the flanges returned to correct perpendicular positions.

Although welding of the heavy beams was of primary interest on this job, it is worth noting that the remainder of the derrick was also welded. Booms and stifflegs were fabricated from A-242 steel and joined with low-hydrogen E7016 electrodes. Base girders were braced with A-7 steel and welded with E6010 electrodes.

Welding, in short, was an indispensable ally of the men who fabricated this giant derrick.

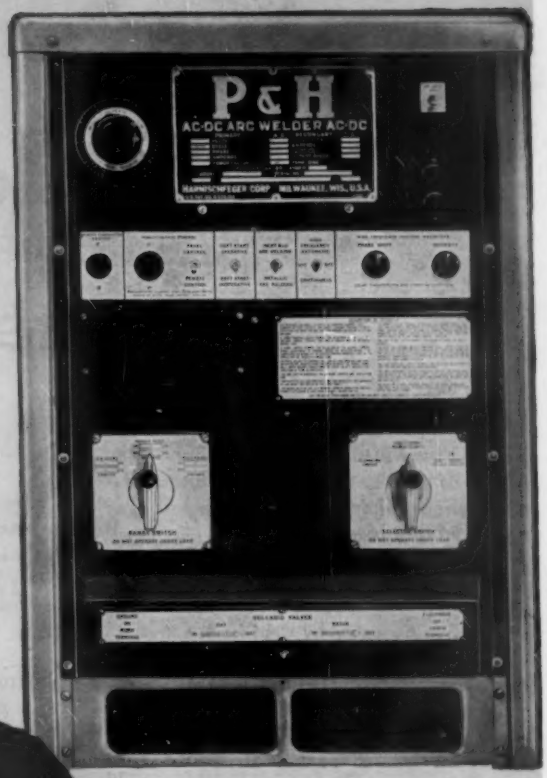
Stop burn through... eliminate craters!

New P&H welders provide

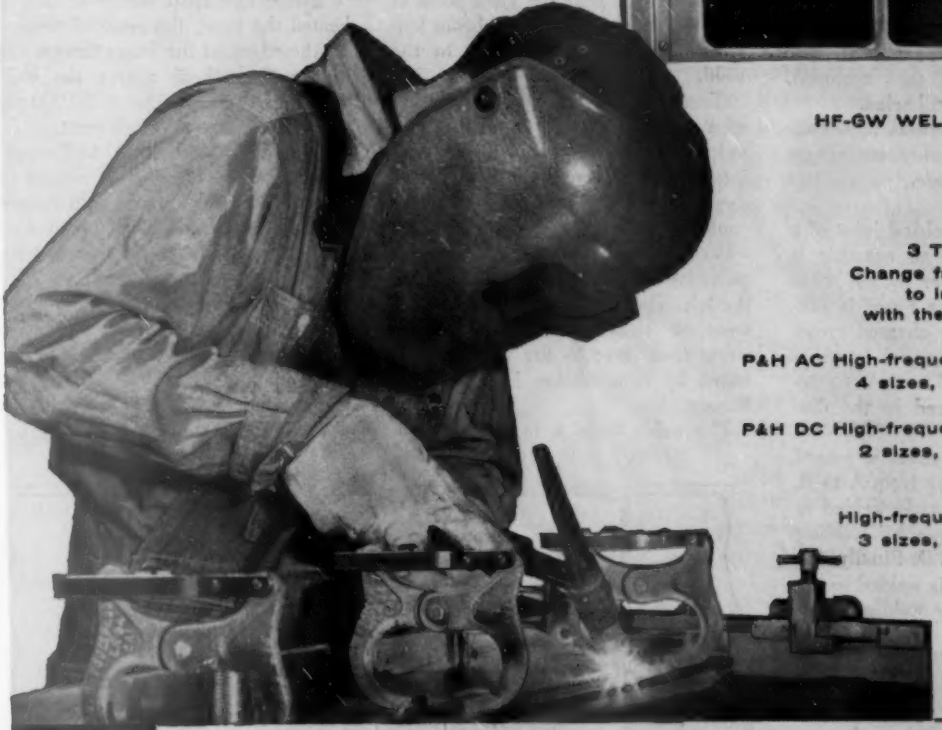
exact heat, perfect timing

for inert gas welding

Built-in high-frequency, gas, water, and spot-gun controls enable you to weld materials as thin as .005 inches without burn-through or craters! The new P&H welders give you P&H "Dial-lectric" control for fast micro-heat adjustment at the machine or by remote control. "Soft-start" device eliminates blasting — phase-shift and intensity rheostats speed arc-starting and stabilize arc intensity over each entire range, eliminate chopping. And for inert gas welding at its best, you can have P&H wave balance built into your machine at extra cost. Write for bulletin "HF Welders," Dept. 317B, Harnischfeger Corp., Milwaukee 46, Wisconsin.



P&H AC-DC
HF-GW WELDER SHOWN



3 Types—9 Models
Change from metallic-arc
to inert gas welding
with the flip of a switch

P&H AC High-frequency WELDERS:
4 sizes, 7 to 670 amps.

P&H DC High-frequency WELDERS:
2 sizes, 3 to 560 amps.

P&H AC-DC
High-frequency WELDERS:
3 sizes, 5 to 670 amps.

P&H HARNISCHFEGER WELDERS • ELECTRODES • POSITIONERS

There has been much pro and con on whether or not tensions created during fabrication can be ignored. In this article, R. E. Holt warns you to . . .

Consider residual stresses when welding

by **R. E. Holt***

FAILURES OF WELDED STRUCTURES invariably give rise to extensive research efforts aimed at determining causes. But the answers resulting from such research have been varied and inconclusive.

Too many engineers believe that residual stresses set up by welding are different than those resulting from external loading, and can therefore be ignored. Others have the notion that, if a strain equal to the elastic strain produced by residual stresses is applied to a weld, then removed, stresses in the weld will relax.

Under certain conditions, these concepts are true—*but they are exceptions to the general rule.*

Using a single welded joint of a wide-flange beam as an example it can be proved whether or not these phenomena apply. The beam is subject to bending since channel crossbeams are welded at equal intervals to the main beam. (The welding sequence can be followed in the diagram.)

The web of the channel is joined to the beam by welding from A to B. The web of the channel is welded to the flange of the beam by welding from A to C and B to D. Finally, the flange of the channel is welded to the flange of the beam by welding from C to E and D to F.

Every reader will undoubtedly agree that there is residual stress in this joint. But just how great the stress is, and whether it is one of tension or compression, will probably cause disagreement.

Before analyzing the stress pattern in the joint, it should be made clear that this is not the welding sequence we would use. But it is one used in many shops doing work of this type.

The weld from A to B causes residual tension near the yield point of the steel in the wide-flange beam longitudinally and transversely to the weld.

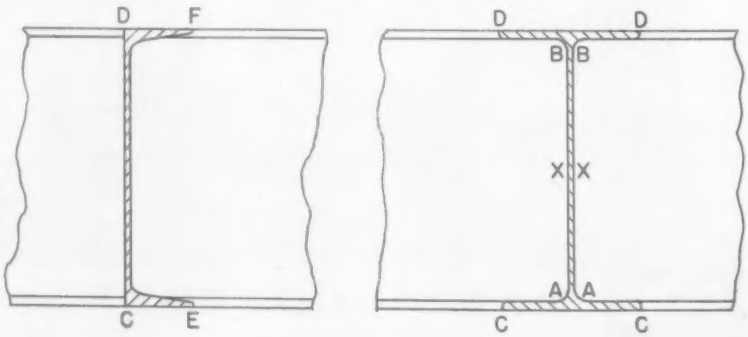
Tension is caused by the heating of a confined area of metal that can only expand by plastically flowing into a thick section when heated and then partially flowing back when cooled. However, the metal will always have its stress equal to its yield point for any given temperature while it cools. The flanges stop other movement or stress patterns, and tensile stress transverse to the weld is balanced by compression in the beam flanges.

The welds from A to C and B to D, when started, are made in relatively thicker metal, where the heat input is the least, than the AB weld. But the overall effect of the heating of another confined volume will be the same as on the web. This induced tension will reduce the tension in the web of the beam transverse to the AB weld.

Since the thin flange section is heated the most, the residual tension on the edges of the beam flanges are higher than those nearer the web, varying from 37,000 psi to 20,000 psi where the flange and web meet.

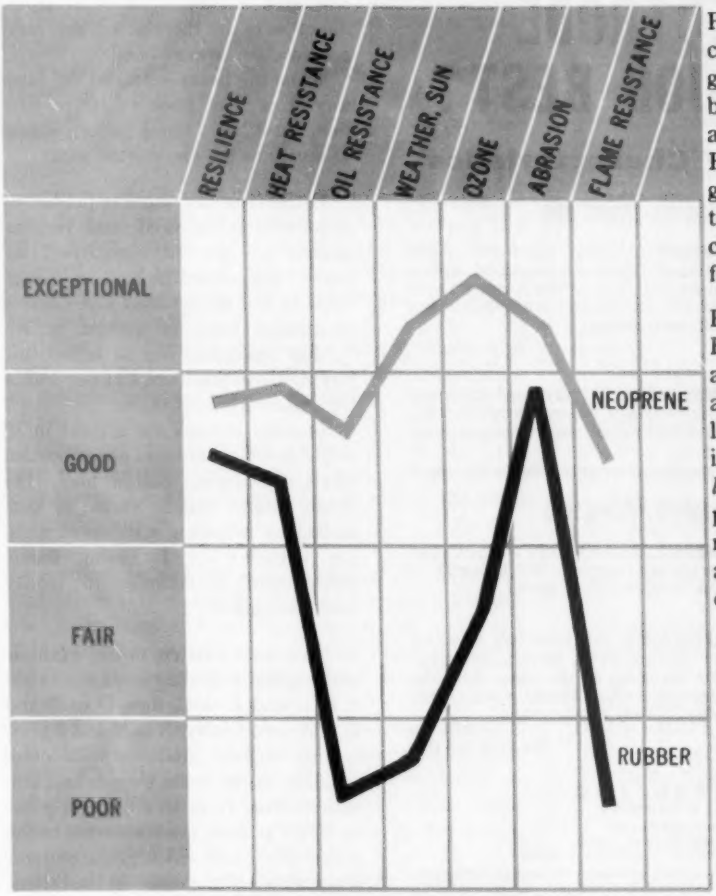
The welds C to E and D to F would not alter the residual stress pattern in the previous welds, but would induce a yield point stress along the edge of the flange parallel to the beam's long axis.

This is a description of the stress pattern at a cross-section of the beam where it is joined by a channel. There is tension in both flanges that must be balanced by compression at some place in the section, it probably occurring in the web when welds AC and DB are cooled.



*Assistant professor of mechanical engineering, University of Washington.

HERE'S PROOF THAT **PHELPS DODGE HABIRPRENE** (NEOPRENE) **ARC WELDING CABLE** IS STRONGER, LASTS LONGER!



(Adapted from chart of Elastomer Chemical Dept., E. I. du Pont de Nemours & Co., Inc.)

Phelps Dodge Habirprene arc welding cable combines maximum flexibility with the greatest resistance to deterioration caused by exposure to harmful physical, chemical and mechanical conditions. The ability of Habirprene welding cable to withstand greater overall wear and tear, as compared to rubber welding cable, is shown in this chart compiled from comparison tables of four rubber goods manufacturers.

Phelps Dodge pioneered the fabrication of Habirprene welding cable, the first real advance in this field, more than 10 years ago. Records show that Habirprene cable lasts much longer than rubber cable and—in some applications—as much as *four times longer!* Although the initial cost of Habirprene is slightly higher, it will more than repay you in long-time service. Habirprene arc welding cable meets full requirements of A. S. T. M. D752.

See your authorized Phelps Dodge distributor for Habirprene arc welding cable with the indelible gold markings—the sign of higher quality, longer-lasting cable.

Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All the above cables are available from stock.

PHELPS DODGE COPPER PRODUCTS

CORPORATION

OFFICES IN PRINCIPAL CITIES

VENTILATED working boxes for

point of nearly 5432 F (3000 C). It reacts with atmospheric oxygen above 752 F (400 C), and becomes brittle

curring in the web when welds AC and DB are cooled.

There are two ways of adding plastic strain to the joint to eliminate these residual stresses.

The assembly can be placed in a giant tensile machine and longitudinally pulled, or the beam can be loaded in its designed position and rolled over and loaded on the bottom until the desired strain is reached.

Except for small laboratory units, the first method is out of the question. The second method seems to be more practical, but it isn't.

When the first load is applied, the top flange will relieve its tension by upsetting the web since the top flange cannot take any compression until its residual tension is counteracted. This will give a similar effect as if the flange were not there at all, and leave a severe permanent bend.

When the beam is loaded the other way it is bent back to its original line, but it has a stress pattern almost as severe as the one started with.

If the line of reasoning previously mentioned is followed, and residual stresses are ignored, dissatisfied customers are created. A load as little as 30% of the design load can cause a permanent bend of several inches.

Most customers can be talked into buying these products, but our industry suffers by such sales.

Residual stresses are present in all welds and these stresses are important when considering design load. The stress pattern can be varied or controlled by following a different welding sequence or by using flame-straightening techniques to rectify faulty sequence.

Now let's return to our example and use the following sequence: weld F to D and E to C, then D to B and C to A, and finally, A to X and B to X.

This method produces mild compression in the beam flanges and tension varying from zero to yield point at X. All stresses are transverse to the welds DBX and CAX. This pattern, when added to the external load stress pattern, will give a stable structure that does not cause yielding of any part of the cross-section.

The best way to eliminate weld failures is not by trying to change the laws of physics, but to accept them and consider the way in which they operate in welded joints.

Ampco-Trode 160 reclaimed this 3,000-pound board drop ram.

WHICH OVERLAY ELECTRODE FITS YOUR JOB BEST?

Guide to Ampco-Trode* Characteristics

AMPCO-TRODE 160

DEPOSIT: High strength and good ductility with average hardness of 160 Brinell. Excellent bearing characteristics — resists squashing-out.

APPLICATION: Overlaying bearing surfaces subject to normal wear and shock. Joining aluminum bronzes, ferrous or non-ferrous fabrications, and dissimilar metals.

AMPCO-TRODE 200

DEPOSIT: Average hardness of 200 Brinell. Highest strength-hardness-ductility ratio of the Ampco-Trode series. Excellent wear-resisting characteristics.

APPLICATION: Widely used for bearing overlays where extreme wear and high pressures are encountered.

AMPCO-TRODE 250

DEPOSIT: Higher yield strength and hardness (average 250 Brinell) than Ampco-Trode 200, with lower tensile strength and ductility typical of the aluminum bronzes.

APPLICATION: Extreme bearing applications where very high pressures are encountered operating against hardened steel surfaces.

AMPCO-TRODE 300

DEPOSIT: Highest yield strength and hardness (average 300 Brinell) of the Ampco-Trode series.

APPLICATION: Fabricating new, or rebuilding worn, ferrous dies used for forming or drawing stainless steels and other clean metals. Other severe-wear applications.

*Reg. U. S. Pat. Off.

AMPCO®

AMPCO METAL, INC.
MILWAUKEE 46, WISCONSIN
West Coast: Burbank, California
Southwest: Garland (Dallas County), Texas

W-148

Bulletin W-17 gives detailed facts on these and other Ampco bronze weldrods. Send for your copy. Tear out coupon and mail today.

AMPCO METAL, INC.
Dept. 186P, Milwaukee 46, Wisconsin

Send me Bulletin W-17.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

VENTILATED working boxes for experiments on oxidation and heat treatment of beryllium in research laboratory of General Electric Co., Ltd., of England.

Modern metals displayed at British welding show

NEW METALS FOR INDUSTRY—titanium, zirconium, tantalum, niobium, molybdenum, beryllium—have many complicated properties which must be considered when welding.

These metals were recently displayed at England's Engineering, Marine, Welding and Nuclear Energy Exhibition at Olympia, London. Their properties and best welding procedures were briefly explained.

Titanium, though relatively new to engineering, is the fourth most abundant metal in the earth's crust. The metal is about half as dense as steel, and has a tensile strength of 25-55 tons psi, which can be raised to 70-85 tons psi by combining it with other metals. Its melting point is 3020 F (1660 C).

At high temperatures, titanium reacts strongly with the atmosphere. It becomes weaker as the temperature rises, though the metal is more useable at such temperatures than most others.

Titanium can be easily hot worked, and most of the normal welding techniques can be used as long as the special chemical and metallurgical properties of the metal are considered.

Zirconium is also relatively common, it being more plentiful than both nickel and copper. The metal is highly corrosion resistant at moderate temperatures, and has a very low neutron capture cross section. These properties make it useful in construction of water-cooled atomic reactors.

The metal is somewhat less dense than steel, becomes highly reactive above 1562 F (850 C), and melts at 3345 F (1845 C). The ease of working it depends on its purity. Especially important is the oxygen content which, in the commercially pure product, is approximately 0.1%, with a hardness of 150 V. P. N.

Recent experiments in England have shown that zirconium can be welded in an argon atmosphere using a standard Tig torch. A direct current gives the best results. When butt-welding sheets of 0.05 in. or thinner, it was found necessary to protect the back of the weld with a flow of argon or a close-fitting copper back-up bar.

Tantalum, first isolated in 1903, is a soft and ductile metal with a density of 16.6 grams per cc and a melting point of nearly 5432 F (3000 C). It reacts with atmospheric oxygen above 752 F (400 C), and becomes brittle when red hot.

The metal's hardness of 80-110 V. P. N. can be increased to about 200 V. P. N. by cold working. Its other properties are similar to those of steel.

Hot working of tantalum is difficult because of its high melting point, so it is cold worked using a lubricant, Tantaroll 2. Carbon tetrachloride is more effective, but highly toxic.

Tantalum can be joined with Tig or resistance welding techniques. It is used in immersion heaters and in condensers for the concentration of strong acids.

Niobium is also a soft and ductile metal which, like tantalum, work hardens very slowly. The substance has a density of 8.6 grams per cc and melts at about 4532 F (2500 C). It reacts with atmospheric oxygen at temperatures as low as 392 F (200 C), also becoming brittle when red hot.

Niobium can be easily forged, rolled or scraped at room temperatures, though annealing is necessary after about 90% reduction in area. The metal is best joined by Tig welding.

Molybdenum has been used in the electrical and electronic industries for many years. But recently, its excellent high temperature qualities have been explored and alloys produced that promise to provide strength at even higher temperatures than the pure metal.

This metal is difficult to work since it tends to remain brittle at very high temperatures. The temperature at which "as-cast" molybdenum becomes ductile may be as high as 572 F (300 C), though cold working can reduce the transition temperature to 32 F (0 C), or lower.

This high transition temperature is due to trace impurities, and until exceptionally pure molybdenum can be produced, it is unlikely that any welding method will produce joints which remain ductile at room temperature, according to the British Information Service.

Molybdenum can, however, be relatively easily brazed. An alloy composed of 75% silver, 20% palladium and 5% manganese has been successfully used for brazing molybdenum in a hydrogen atmosphere.

Beryllium has become extremely important as a canning material for fuel elements of advanced gas-cooled, graphite moderated nuclear reactors.

Its melting point is approximately 2336 F (1280 C), but it retains adequate strength and mechanical properties up to 1112 F (600 C), which is at least 302 F (150 C) higher than the temperatures at which reactors cooled by CO_2 are currently operated.

Beryllium's toxicity causes the main difficulty when welding. Even minute quantities of it inhaled, absorbed through the skin or swallowed can cause dangerous poisoning.

Because of this, firms interested in development work on beryllium have had to design special buildings with independent ventilation systems.

In such buildings, weldors work in ventilated boxes, access to which is by means of arm-length rubber gloves sealed to the enclosures. Machining and grinding are confined to special sections in the buildings.

WATERS of Bolivian rivers contain rocks, tree trunks and other debris that play havoc with missionary boats and their propeller shafts. At left, Brother Dismas heats shaft that was twisted out of shape by submerged rock. At right, he hammers shaft straight, and will soon be on way again. Brother Dismas, a mechanic prior to joining mission, is its "chief engineer."

A former Texas mechanic finds . . .

Boating is no pleasure in Bolivian waters

A SUDDEN JAR, the sound of twisting metal, and the boat's motor stops.

A big, calm man, Brother Dismas (James Harness of Houston), a missioner at Padres de Maryknoll, Riberalta, Beni, Bolivia, appears on deck. He scans the water and shoreline for alligators and the fierce piranha fish that can tear a man apart with ease.

When all is clear, Brother Dismas dives beneath the boat, loosens its propeller shaft and drags it ashore. Once a fire is built and the shaft heated, a strong hammer and arm undue the damage meted out by a submerged rock.

Small boats are the main means of travel for the Maryknoll Brothers when they visit mission outposts, and sunken debris in the Bolivian waters often cause scenes such as the one described.

Bronze shafts were once used on the boats, but the metal could not take the abuse from the river debris. Steel was also tried, but it rusted too fast.

Brother Dismas has installed in one of the boats an International Nickel Co. Monel shaft which, he reports, is durable and corrosion-resistant. He plans to install them in all mission boats.

BROTHER Dismas salvages a steel propeller shaft by overlaying it with corrosion-resistant Monel. At right, Brother Dismas inspects new Monel shaft.

Your Guarantee of Genuine EUTECTIC "Low Temperature Welding Alloys"

Original EUTECTIC Helps You obtain superior welds with Highest Strength and Maximum Machinability.

In the months to come, "Little Hugh-Tec" will make his appearance in shops throughout the country, on labels and packages, to identify the Original and Genuine Eutectic "Low Temperature Welding Alloys"® that Help You to obtain the finest welds with maximum machinability and highest strength.

The many advantages associated with the use of EUTECTIC "Low Temperature Welding Alloys" are based on proven techniques that apply only to our products which permit low heat input welding. Through the use of our alloys and techniques, you can bond metals below the critical range and thus reduce to a minimum the warping and distortion that is associated with high-heat methods. You wouldn't attempt to use a 400 ampere motor generator to weld 24 gauge material, and you would be just as much in error to attempt to use conventional rods with techniques developed for EUTECTIC "Low Temperature Welding Alloys".

The whole concept of low heat input welding, pioneered and developed by our company over a period of fifty years, is based on a phenomenon of surface alloying, without diffusion of the parent metal, first discovered by J. P. H. Wasserman, the founder of the company. Today, the EUTECTIC Welding Alloys line consists of over 160 products that are manufactured and sold throughout the world. Many of the products and processes responsible for this growth are protected by over 100 U.S. and foreign patents that prevent imitation, and your surest guarantee of successful welding is your insistence on only those products that bear the Genuine label.

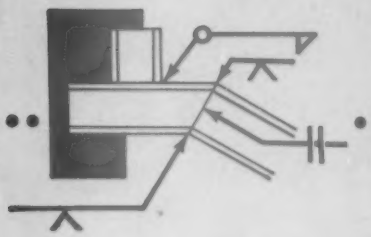
Weldors everywhere have come to depend on the Safer, Stronger, Better Welds that are assured through the use of EUTECTIC "Low Temperature Welding Alloys". Furthermore, no other supplier insures such an outstanding advisory and demonstration service as that offered by Eutectic Welding Alloys Corp. It maintains the largest trained field force of welding specialists in the Western Hemisphere. Whether you buy five pounds or five thousand pounds, you can obtain real assistance when and where you need it. There are no substitutes for Quality and Service and you are guaranteed of both when you use EUTECTIC "Low Temperature Welding Alloys".

ORIGINAL Low Temperature EUTECTIC WELDING ALLOYS

® REGISTERED TRADE MARK OF

©1959 EWAC

EUTECTIC WELDING ALLOYS CORPORATION
40-40 172nd STREET FLUSHING, N.Y.



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

How to Tig weld stainless steel tubing

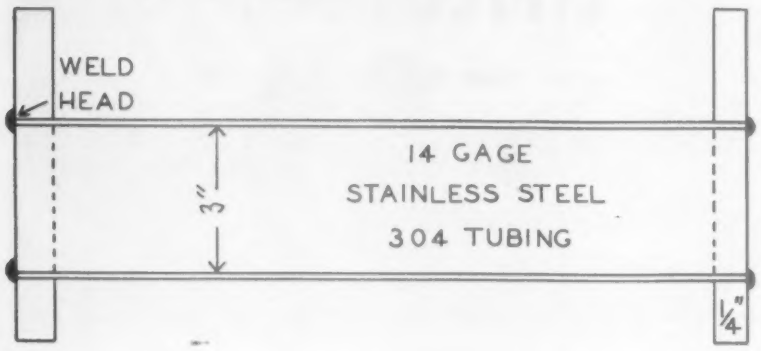


Fig. 1

Question:

Will you please furnish me information pertaining to the accompanying sketch (Fig. 1). Could these joints be Tig welded with argon? Also, what precautions should be taken in such welding procedure?

Answer:

You can easily Tig weld this job using the following procedure. First, bevel the plate 45 deg to about a 1/16-in. depth. Push the tube through the plate so it protrudes about 1/16 in., and melt the protrusion down to the bevel (Fig. 2). To do this, place the tungsten electrode at an angle from the inside.

A current of 90 to 120 amp should be used with a 1/16-in. tungsten electrode, and 11 to 13 cu ft of argon per hour for this job. This will provide a good welding speed.

It cannot be determined from the drawing whether you are welding a heat exchanger, many tubes to a tube sheet, or merely welding a ¼-in. flange to the end of single tubes.

It makes little difference, except if you are making a heat exchanger. If so, the tubes should be rolled into position to get a good fit. This will avoid oxidation on the back side of the weld. If a good fit cannot be had, be sure to use an argon backup.

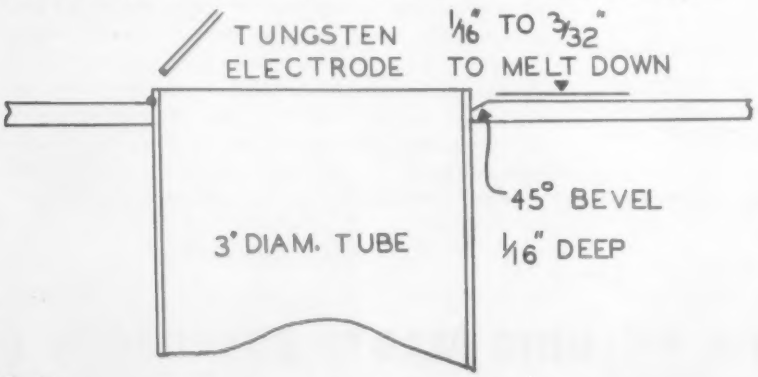


Fig. 2

Question:

What are the best methods for strength testing single and double aluminum fillet welds?

Answer:

Aluminum fillet welds are not usually strength tested, but when they are called for, a cruciform specimen can be used for tests in transverse shear, and a cover plate specimen for tests in longitudinal shear.

These tests are also useful because they many times indicate certain gross defects, according to The Aluminum Development Association of London.

Simple fracture methods, such as the nicked break test, can be used to test single fillets. By bending the weld in a vice and breaking it open, porosity, oxide film inclusions and lack of root fusion can be seen.

Macro-examination of a cross section is the best procedure for testing double aluminum fillets. Among etchants recommended are 10% caustic soda, and 10% cupric chloride followed by swabbing with concentrated nitric acid. A milled or turned surface is the best for such tests, but a filed one can be used.

This form of examination also provides good quality control because it shows lack of fusion, inclusions of slag and pores exceeding 1/64 in.

Micro-examination is used for high-quality work especially to reveal fine porosity. Though this is sometimes present, the Association says it has little effect on strength.

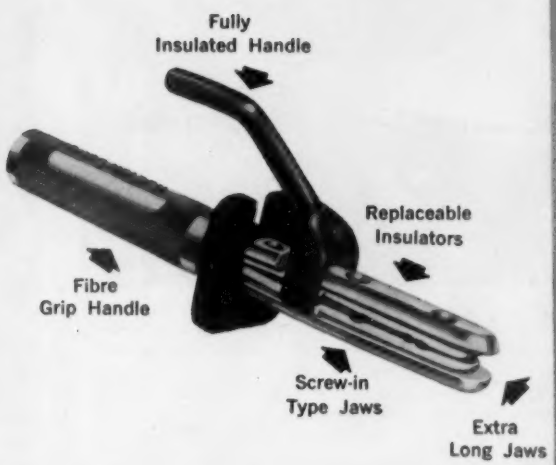
Along the same lines, grain size does not seem to affect the static mechanical properties of aluminum welds, and need not be checked.

For 27 Years Preferred By Welders

THE DURO "STANDARD"

- All Parts quickly replaced with a screwdriver
- Screw-in type jaws — No tools required
- Insulated Handle and Guard — Protects operator
- Rugged Fibre Handle — Lasts longer
- Cool Operation — Cool Handling

Featuring "Long Jaw design" for reaching those "hard to get at places"



The New Duro "DUROGON" Tong-Type

THE DUROGON-N3 and N3HD

- All Parts quickly replaced with a screwdriver
- Fully Insulated — Greater safety
- Cool Operation — Cool Handling
- With ALUMINUM Body — Less operator fatigue
  Mechanical Cable Connection
- With BRONZE Body — For heavy duty operation
  Mechanical, soldered or brazed connection

"The BEST of this Popular Design!"

DURO ENGINEERING COMPANY · 31 OREGON AVE. · HAMDEN, CONN.

OPERATOR removes flux and cleans weld after automatic welding of a stainless steel seat in valve disc for 96-in. diameter butterfly valve at Allis-Chalmers' West Allis, Wis., works. Eight of these rubber-seated valves will be installed at Ice Harbor dam project on Snake River in Washington. Valves will operate in fish attraction systems with pumps controlling water flow.

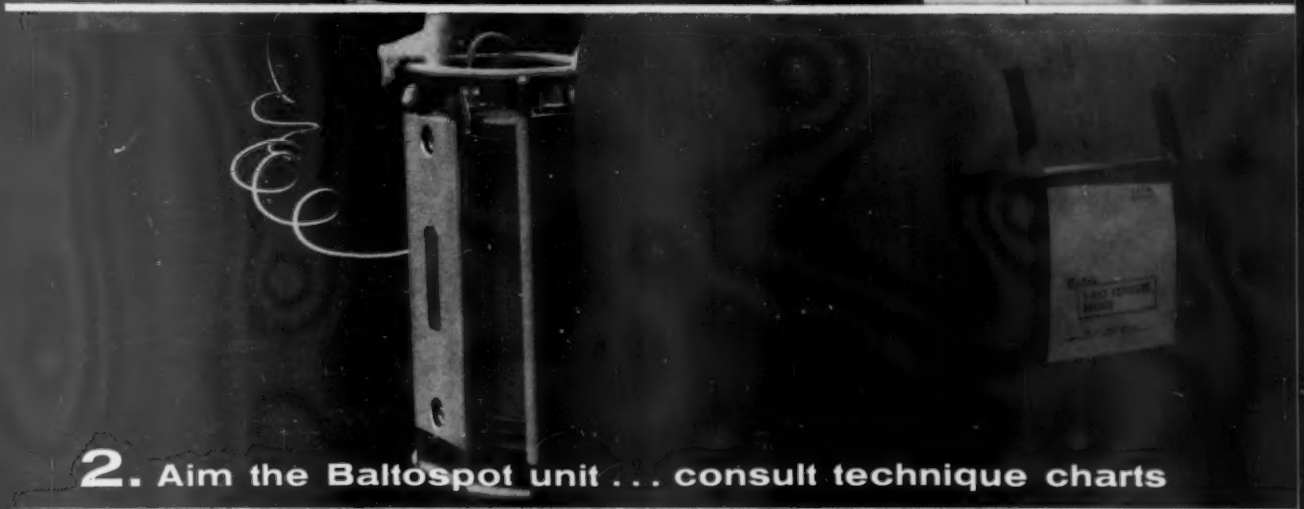
MANUFACTURING engineers at Martin Co., Baltimore, use scientific sniffer to locate fuel leaks during sealing of integral wing tanks on P6M Sea-Master jet seaplanes. Sniffer is said to detect source of leaks inside a wing fuel tank in matter of minutes, as compared to many hours normally needed. Sniffer is an infrared analyzer which uses nitrous oxide gas to trace path of fuel leak from outside back to its source inside tank. Here, gas is injected by operator from outside through opening where leak was observed. Gas then follows path of leak back inside wing to source where it is detected with sniffing probe operated by workman inside wing. Neon light is actuated when source is found. Gages on mobile detecting stand are hooked up to probe to measure leakage.

On the job...

WELDORS join 18-in. natural gas pipe for East Coast line. Martin Friedmann, Jr., Norfolk, Va., was contractor. Pipe sections were placed with 5/32-in. gap, without back-up rings. Inspectors often had to climb inside pipe to check penetration.

WORKMEN assemble Fruehauf Trailer Co. stainless steel trailer said to be lightest one for its strength manufactured. Unit-welded structural members are typical of construction. Sidewall panels, siderails, crossmembers and clips are electrically welded to form unit. With welded design, manufacturer eliminates rivets, bolts and screws with comparable saving in cost. More than 7,200 welds are used in average trailer sidewall. Attempts were made to break sidewalls and make welds fail, but welded construction withstood all tests. Stainless steel for trailers is provided by Allegheny Ludlum Steel Corp., Pittsburgh.

1. Attach the film holder



2. Aim the Baltospot unit . . . consult technique charts

3. Set the controls . . . press the button!

YOU'VE JUST MADE A WELD X-RAY!

Taking repetitive or field X-rays is a 1-2-3 operation with this Baltospot portable unit—can be learned in less than a day. You simply carry the unit to the job, X-ray the weld, and develop the film—all in a matter of minutes.

And don't forget—X-ray weld inspection is a real cost-cutter, too (77% savings on inspection were recently reported by a prominent tank fabricator).

For the whole story, contact your nearby Westinghouse X-ray sales representative. Or write: Westinghouse Electric Corporation, X-ray Department, 2519 Wilkens Avenue, Baltimore, Maryland. J-08378

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Welding + lightweight metals = portable tractor . . .

for combat area construction

NICKNAMED BAT, this all-purpose, all-welded tractor fills the Army's need for a portable, heavy-duty construction aid for use during combat.

"WHAT WE WANT is an earthmover that can do the work of conventional scrapers, dozers, and tractors . . . but which weighs only half as much . . . can be parachuted into a combat area, or flown in by helicopter. And we want it soon!"

That was the demand made by the Army of its Engineer Research and Development Laboratories. Was it fulfilled? Yes—through the ingenious efforts of a designing team and the sure-joining, weight-saving advantages that only welding can supply.

Weight was obviously the major obstacle. Commercial vehicles used by the Corps of Engineers weigh approximately 27,000 lb—far too much heft for easy air transportation or parachute dropping.

Designers from the Research and Development Laboratory looked at the problem . . . and thought they saw an answer.

If, they reasoned, you can fabricate a lightweight vehicle that can be air-dropped, then double its weight once it hits the ground by filling it with dirt, you should have a light piece of equipment that is a glutton for work.

Thus was born the idea of BAT (ballastable all-purpose tractor). It would weigh 16,000 lb empty; 32,000 lb loaded. By fabricating the tractor in three segments, front end, scraper bowl, and rear end, each section could be parachuted to the ground, then quickly assembled.

Once in a combat area, the scraper bowl could be filled with ballast for dozing and tractor operations. If and when scraping must be done, the machine would be able to eject its ballast from the bowl.

To move the unit, the earth would be dumped, BAT broken down and flown out by helicopter.

This was the goal—but how was it to be reached? How could weight be cut without lowering efficiency and strength? Designers from Barnes & Reinecke Inc., Chicago engineers, answered these questions in three ways: By using lightweight plating, efficient components . . . and by welding.

To see how engineers applied these answers, let us examine BAT's rear axle housing in more detail. The housing weighs only 700 lb as compared to the average commercial vehicle's 3,000 lb. This weight economy was reached by using $\frac{1}{8}$ and $\frac{3}{16}$-in. plate in place of the usual 1 and 2-in. plate.

Using manual metal arc welding, a prototype of BAT was fabricated by Hendrickson Mfg. Co., Lyons, Ill. More than 300 welds were needed on the Man-Ten steel used for the axle housing, the weldors drawing power from a 400-amp, a-c welder. An E8016 low hydrogen electrode, 5/32-in. in diameter, was used. Current settings ranged from 100-150 amp.

Despite the job's complexity, and the fact that no jigs or fixtures were used, axle housing tolerances were held within $\frac{1}{8}$ in. of the designer's requirements. Most of this error, however, was erased by machining after the housing had been normalized.

In all, 90% of BAT was fabricated by welding. The list of welded components includes axles, axle housing, yoke, arms, dozer blade, scraper bowl, scraper blade, operator's platform and gasoline tank.

Pins and bolts were used in moving parts, and at points where the tractor is disassembled for air-drops.

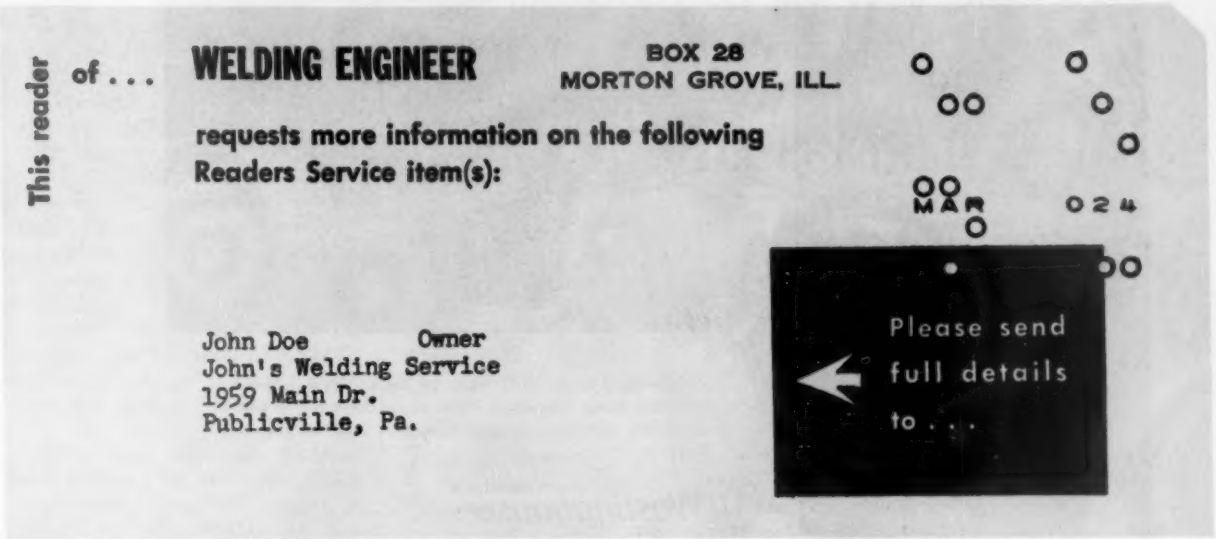
The heavy structural members in BAT's lower half are of T-1 steel, the upper half, being mainly the scraper bowl, is Man-Ten. The T-1 used varies in thickness from $\frac{3}{16}$ in. to $\frac{1}{2}$ in., depending on its purpose. To avoid cracking during heat treatment a $\frac{1}{8}$ in. diameter E12016 electrode, well above T-1's rated tensile strength, was used. Power source and current settings were the same as for the axle housing.

A 250-hp engine powers BAT's 14 speeds. To provide dig and drive, the engine was mounted in the vehicle's rear and coupled to generators which drive front-end motors. This arrangement provides the tractor with 10 forward speeds on the rear-end for push, and a two-speed front end for pull. Two reverse-speeds complete the gear box.

During fabrication, most distortion was slight and easily controlled. Problems did arise, however, with dozer blade construction. Welds had to be made that would help the blade endure the major shocks it would be subjected to.

But proper welds were designed that have stood up to the shock of air-drops and construction work.

Your ticket to better service



Now, the more-than-70,000 inquiries sent in yearly by readers of WELDING ENGINEER are receiving automatic attention. This consists of mechanized handling combined with human inspection to insure prompt and accurate forwarding of these inquiries.

Here's what is done:

Card Printed For Each Item Circled

1. Coupons are separated, counted and address plates are cut for inquirers' names and addresses.

2. For each item circled on the inquiry coupon, a card is printed. These go thru the key-punching machines where they are punched with the number indicated on the coupon. Then the name and address on the card are proof-read for accuracy.

Double-Checked For Accuracy

3. The punches are then read by an electronic interpreter which prints what it reads. Again, the card is proof-read to see that the correct item-number appears on it.

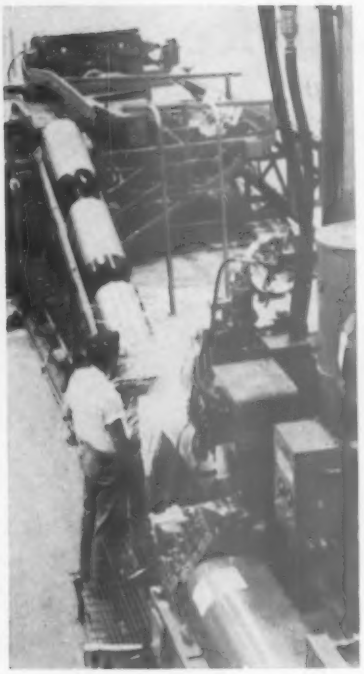
Quickly Processed

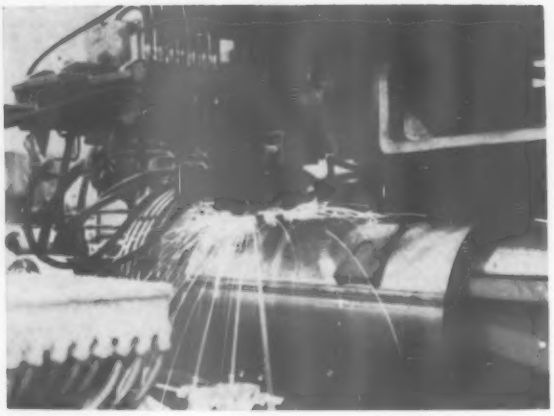
4. After a number of cards have been printed, a sorter brings together all the inquiries for a certain item, counting the cards as it is sorting.

Permanent Records Made

5. Tabulations are recorded on sheets for permanent records.

This change in inquiry-handling means better service for both reader and manufacturer—another way in which your "best bargain in welding," WELDING ENGINEER, works for you





SEAM-welded tanks (left) move up the conveyor to machines for bead and flange operations. Photo above shows one of five completely automatic projection welders used on the line.

At Westinghouse . . .

High automation is the key to speed, economy and efficiency

TURNING OUT distribution transformers at the rate of one every two minutes is no trick at Westinghouse Electric Corp.'s new 561,000 sq ft plant on 240 acres near Athens, Ga.

Highly mechanized production and materials-handling equipment make possible economic, efficient fabrication of these transformers. The almost five miles of materials-handling equipment includes in-floor tow lines, overhead monoveyors, power-and-free conveyors, and many special racks, trucks and transfer devices.

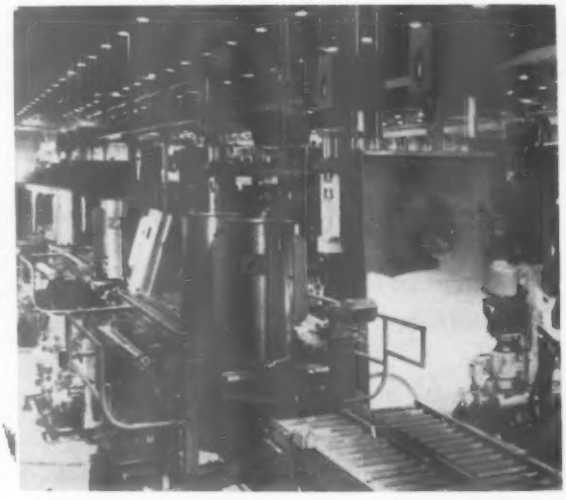
An example of the plant's high automation is the mechanized line fabricating the transformer tanks—also at a rate of about one every two minutes.

The line consists of 15 major machines, integrated with 10 automatic positioners, two automatic turnovers and approximately 525 ft of powered roller-conveyors.

The equipment performs 55 separate operations, including Mig (metal inert-gas) welding, projection welding, seam welding, metal forming, marking, punching, bottom seaming and leak testing, on each tank in a continuous automatic operation.

Production starts with a magnetic de-stacker automatically feeding single tank-wall sheets over a powered conveyor to a press. A small hole (used subsequently as a position reference and later for processing) is punched in each flat sheet, which are then automatically stencilled with a style number and rolled into cylinders.

The cylinders are fed continuously, end-to-end, into a side-seam welder. At the grinding station, 3-in. sections are removed from each end



VIEW of tank fabricating line shows front tank positioned radially for Mig welding hangar lugs. Note fins have already been projection welded.

of the tank shell. An inclined power conveyor then feeds the shells to a dual-gravity conveyor which selects and sends the tanks to either of two machines for automatic bead and flange operations.

Each shell is tilted 90 deg from the horizontal and fed to the first of eight automatic welders and two punch presses.

An automatic positioner (integrated with the 10 machines) orients, clamps, raises and lowers, transfers and tilts the tanks through the entire fabricating sequence.

Five of the 10 machines are similar projection welders used to join various pads, lugs and studs to the inner and outer tank walls. All are single phase and rated at 400 kva.

There are also two identical seam welders (150 kva, three-phase) which weld one or two lengths of fins, in any sequence, to the tank wall. (Specially designed arms feed fins from a hopper, hold them against the tank shell during welding, thus eliminating any tack-welding.)

Another station on the line has a specially designed Mig welder which joins either two or four hangar brackets to each tank. Parts are again held stationary by a positioner.

The line also incoporates a unique hydraulic bottom-seamer. Tank bottoms are fed from a loader and laid onto a powered incline-conveyor which feeds and presses the bottoms into the tank shells. Tank and bottom are then transferred to the bottom-seaming station.

At the leak test station, a non-magnetic fluorescent penetrant is sprayed inside the tank. Any leaks can be detected by the penetrant's glow under a black light.

An automatic turnover then upends the tank with the open (top) end up for positioning over the lower horns of the punch presses where bushing and circuit breaker, and signal light holes are made. The presses can punch or form the holes in any required number or sequence.

A second turnover upends the tank again (bottom up) exposing a small ring previously projection welded to the tank bottom center. A carrier on an overhead conveyor engages the loop and carries the tank through the cleaning and painting line, another highly automated production procedure at the Westinghouse plant.

Warehouse stocks in all important cities and towns.

SHAWINIGAN

shawinigan PRODUCTS CORPORATION
EMPIRE STATE BLDG., NEW YORK 1, NEW YORK
PLANTS: Keokuk, Iowa; Pryor, Oklahoma; and Shawinigan Falls, Quebec, Canada

MERRILL MB BROTHERS
MATERIAL HANDLING DEVICES

- Safety Factor—5 to 1
- Factory tested at triple rated capacity.
- Will lift from horizontal or vertical position.
- Cam and Pads of case hardened tool steel.
- All operating parts replaceable when worn.
- Swinging or jerking loads will not affect grip.
- Useful for positioning in welding operations.

The HEAVIER the LOAD • • • the TIGHTER the GRIP! 3-T-17

MERRILL BROTHERS
56-81 ARNOLD AVE., MASPETH, N. Y.

In Head and Eye Protection

486A GOGGLE. Flexible mask is very comfortable vinylite. Lightweight. A "2-in-1" goggle — can be worn by welders who wear Safety Rx or personal glasses, and those who do not.

301A GOGGLE. This chipper's goggle, with new dome-type side shields, provides up to 15% more ventilation than the old flat side shields. Eyecups fit facial contour closely, eliminate any opening for particles to enter.

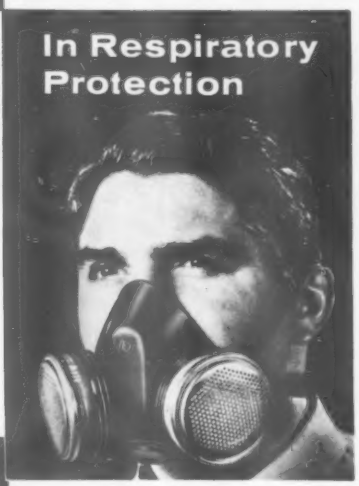
9706 HELMET. Revolutionary radio dial adjustment at rear. Easily adjusts to head size, eliminates slippage. Fiber glass shell resists moisture. No warping or cracking. Lift front insulated aluminum glass holder. A very popular helmet, as is companion Model 9702 without lift front.

In Body and Hand Protection

208 BCL CAPE SLEEVE AND BIB. Here's comfort in lightweight flexible leather for welders working on gas shielded electric welding where Argon, Helium and similar gases are used. Protects arms, chest, shoulders. Double stitched seams. Seam ends steel rivet reinforced. Snap fasteners attach bib. Armpit anchor buttons keep cape from unbuttoning. 5 sizes.

SC 5X163 GLOVE. Preferred for its exceptional resistance to heat on gas and heaviest amperage electric welding. Specially chrome-tanned split cowhide leather. One-piece back and palm. Welted at all vulnerable seams. Extra heavy lining on back of hand. 14" long.

In Respiratory Protection



R5056 RESPIRATOR. Offers Bureau of Mines Approved protection against metal fumes in welding, burning and cutting. New "miracle" filters provide highest efficiency and long service life.

Whatever the Protection Required...AO has a Performance-Proved Product for the Job!

Always insist on AO Trade-marked Safety Products

American Optical Company
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Your nearest AO Safety Products Representative can supply you.

Analyzing metal cleaning costs

The method . . .

Cost analysis of metal cleaning operations must take into account:

Investment—The amount of capital tied-up in the cleaning machine, its installation, building space, and utilities for operation of the machine.

Operating cost—The hourly cost of running the machine.

Investment carrying cost—The "cost" of the capital tied-up in the investment items above.

In making a cost analysis of this type, only the major investment items and operating costs need to be considered. Specifically, these items are: machine price, steam or gas requirements, labor requirements, and solvent or chemical requirements.

All other items, such as maintenance costs, are allowed for by special factors developed by the Du Pont Electrochemicals Dept. of E. I. du Pont de Nemours & Co. of Wilmington, Del.

Required information . . .

This required information relates to the elements in the cost analysis worksheet below.

A—Steam or gas requirements: lb/hr or cfh.

B—Machine price: in dollars.

C—Solvent or chemical requirements: lb/hr.

D—Labor requirements: man hr/hr of machine operation.

INVESTMENT

Utilities investment[1] (lb steam/hr x steam investment factor[2] x 1.07) $_____

All other investments (machine price x 2.6) $_____

TOTAL INVESTMENT $_____

HOURLY OPERATING COSTS

Solvent or chemicals (lb/hr x $/lb) $_____

Utilities cost[3] (lb steam/hr x $1.20/1,000 lb x 1.2) $_____

Labor (man hr/hr of machine operation x $/hr x 2.0) $_____

Maintenance, depreciation, taxes and insurance $\frac{\text{(machine price x 0.10)}}{\text{hr of operation/yr}}$ $_____

Cleanout[4] $\frac{\text{(man hr/cleanout x cleanouts/yr x \$/hr x 2.4)}}{\text{hr of operation/yr}}$ $_____

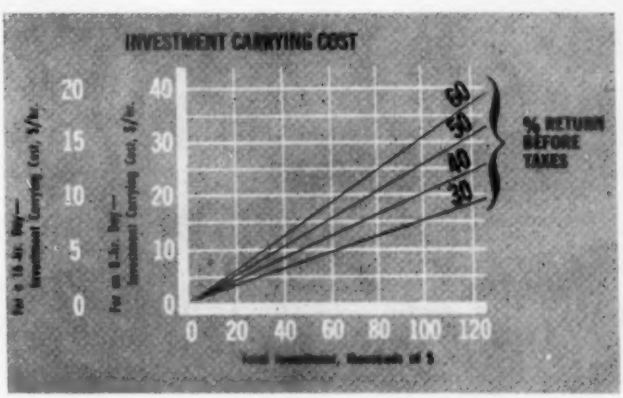
Investment carrying costs[2] $\frac{\text{(\$ total investment x \% return before taxes)}}{\text{hr of operation/yr}}$ $_____

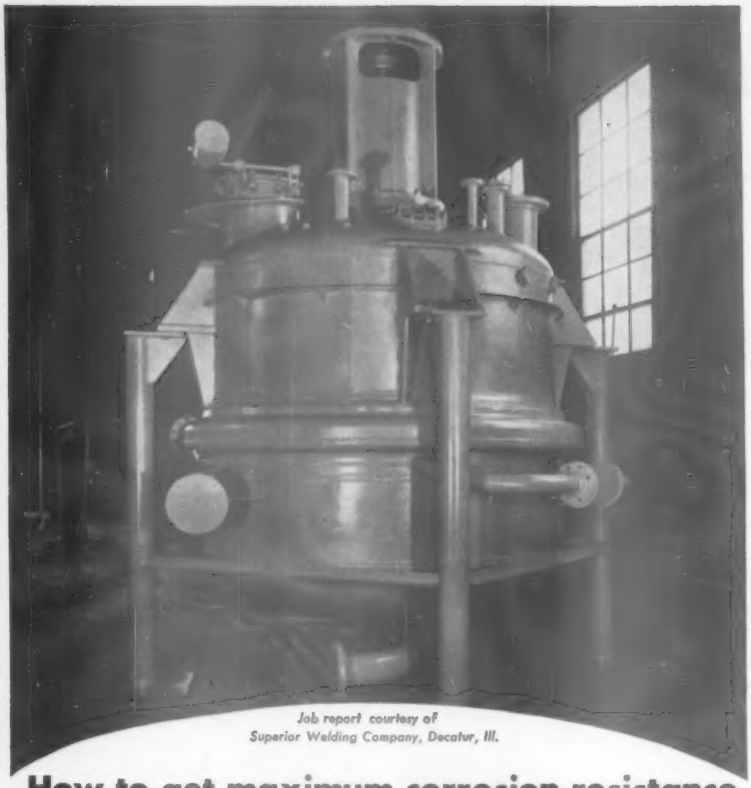
TOTAL HOURLY COST $_____

1—Where gas heat is used (cfh x $100/1,000 cf x 5).
2—See data for estimating costs below.
3—Where gas heat is used (cfh x $0.80/1,000 cf x 1.05).
4—Applicable only where soil is heavy.

ESTIMATING COST DATA

Steam investment factors	$/lb of steam
Large boiler stations	
Oil fired	8
Coal or gas fired	10-15
Package industrial boilers	
Large units (60,000 lb/hr)	6
Small units (5,000 lb/hr)	12-15
Semi-industrial boilers	
Small (200 to 3,000 lb/hr) oil or gas fired	3-6





Job report courtesy of
Superior Welding Company, Decatur, Ill.

How to get maximum corrosion resistance from Welded Stainless Steels

WELD WITH ARCOS

STAINLESS ELECTRODES

This reactor type vessel is used by the chemical industry to produce paints and resins. Effective resistance to corrosion depends largely upon the quality of its welded joints. Arcos CHROMEND HCN and CHROMEND K-LC Electrodes were selected to meet these critical demands. The inner vessel is 304 ELC clad carbon steel—all other parts in contact with the charge are also 304 ELC. Whatever *your* job, there's an Arcos Stainless weld metal of the right analysis for dependable results. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

Most job shops unaffected by recession

"WE'RE BUSIER THAN HELL."

That's the emphatic answer one job shop owner gave to the question, "How is business?" And his answer epitomizes the prevailing situation, in thousands of welding shops throughout the country.

Last year's recession seems to have had little effect on these smaller enterprises—certainly less effect than was felt by large fabricators. Many job shops had fewer calls for contract welding during much of last year, but repair work increased sufficiently to more than offset any loss of the former.

WELDING ENGINEER has often opined that welding is a depression-proof industry. This seems to be borne out by the continuing prosperity enjoyed by welding job shops (at least by those whose customers pay their bills).

A typical example of the busy establishment is Buffalo Radiator & Welding Co., Buffalo, N.Y. Owned by brothers Theodore and Ralph Huff, the firm has been in existence almost 15 years. Both men had metal-

GASOLINE tank is being repair welded by oxyacetylene process, using mild-steel filler rod. Tank was purged by steam prior to welding.

COLD-rolled steel edge is being welded to flights of conveyor screw for blacktop spreader.

working experience before embarking on their own.

On the day *WE* visited the Buffalo shop, Fred Huff, son of Theodore, was welding one gasoline tank, while another was being purged with steam out in the yard. Later that same day, Fred donned a helmet, and with an E6012 electrode welded a new cold-rolled steel edge to the mild-steel flights of a conveyor screw from a blacktop-spreading machine. Electrode diameter was 1/8 in. and current was 115 amp, d-c straight polarity.

Other non-automotive assignments for Buffalo Radiator include hardfacing of construction equipment and some stainless-steel welding.

The firm's equipment consists of four oxyacetylene welding and cutting rigs, two arc welders (one motor-generator, the other a combination a-c/d-c machine) three pick-up trucks and one heavier tow truck.

One of the trucks is assigned primarily to field welding and repair work. It carries an oxyacetylene outfit and the m-g welder and is equipped with a winch.

With welding the answer to practically every metal repair problem you can encounter, it's no great wonder that job shops are busy and, we hope, prospering.

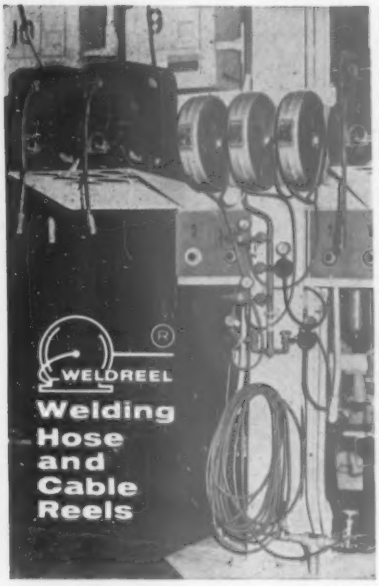
Job Report Courtesy of Electric Boat Division, General Dynamics Corp., Groton, Conn.

For maximum weld strength at sub-zero temperatures

WELD WITH ARCOS

LOW ALLOY ELECTRODES

The Skate (above), as well as the Nautilus, Seawolf, Swordfish, Skipjack and Triton are among the "greats" in America's atomic powered sub force carrying welds produced by ARCOS low alloy electrodes. ARCOS Tensilend 80, 100, 120 and Ductilend were used to assure welds of highest possible impact strength whether on missions in the tropics or the sub-zero arctic. When you need weld metals with similar qualities, ARCOS is well worth remembering. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



AT PHILLIPS PETROLEUM

Plant safety is improved —hose and cable life extended —good housekeeping is made simpler—in Phillips Petroleum Corporation's refinery at Borger, Texas, by keeping hose and cable off the floor when not in use—with WELDREEL hose and cable reels.

WELDREEL reels pay out freely and lock automatically at desired length. A slight tug releases the locking pawl, allowing hose or cable to be automatically retracted.

Designed to handle flammable fluids and gases safely in dual and single hose, leakproof WELDREEL reels are adaptable to a wide variety of industrial applications. Write for full information.

MODEL OA-A holds 50′ of 3/16″ or 40′ of ¼″ dual hose. Model OAB has capacity for 150′ of ¼″ or 125′ of 5/16″ hose.

MODEL EA-2 with current capacity of 300 amps holds 50′ of 2/0 welding cable. Model EA has capacity of 100′ cable.

MODEL A-1 has 50′ capacity of ¼″ or ⅜″ I.D. single hose. The larger Model A-2 holds 50′ of ½″ hose.

UNITED SPECIALTIES INC.
POST OFFICE BOX 610 — EL DORADO, ARKANSAS

OPERATOR adjusts fixed-pressure two-stage regulator. Only one outlet is in use, the other is cut off with plug and chain assembly.

by **R. W. Tuthill***
Air Reduction Sales Co.

New regulators cut waste of inert-gases

THE COST-INCREASING problem of wasted gas when inert-gas welding has been eliminated with development of a new line of fixed-flow regulators, by Air Reduction Sales Co.

Gas-flow rate adjustment largely determines ultimate gas consumption for inert-gas welding processes—now this consumption can be cut as much as 50%.

Flow rates cannot be adjusted on these new regulators. With a proper flow adapter, the regulator will deliver only the desired flow rate, and will remain at that rate, cutting possible waste to a minimum.

Close control is accomplished with flow adapters which screw into one of three fixed-pressure regulators: single-stage, two-stage, or "B" station valves. (Adapters are interchangeable orifices providing a predetermined flow that cannot be reduced or exceeded.)

Single-stage regulators are designed specifically for use with one arc. With the two-stage type, two flow adapters can feed different flow rates from one regulator to separate arcs. This latter type can also be used with two entirely different inert-gas processes simultaneously.

"B" station valves are best suited for pipeline manifold systems. Each station can be equipped with a flow adapter geared to that station's particular operation without interfering with other stations.

The savings to be gained will depend on the particular job. To calculate these savings, use the following formula:

Savings in dollars/week/arc = (R-r) x D/100 x H x G: where R = flow rate now being used (cfh); r = minimum rate allowable without impairing quality; D = duty-cyle arc time versus down time; H = hours/week/arc; and G = gas cost/cu ft.

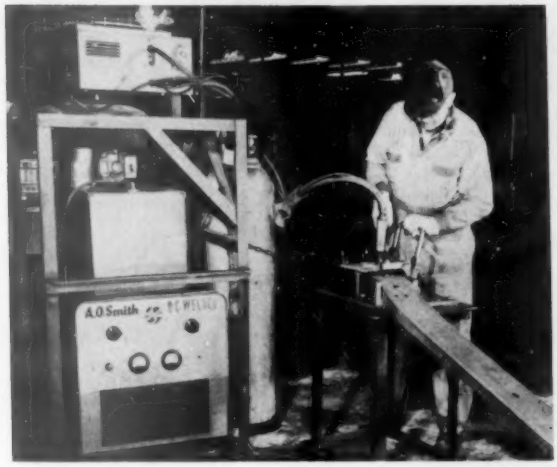
Minimum flow rate must be determined prior to using the regulators and depends on specific conditions, *e.g.*, drafts, current level, gas used, nozzle-to-work distance.

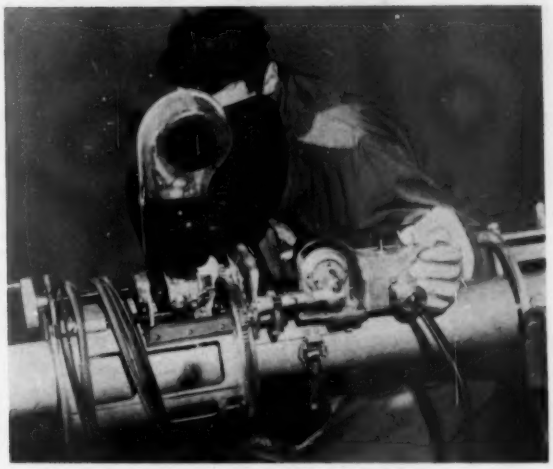
To determine the minimum rate, reduce gas flow gradually while welding. When the puddle surface discolors, increase flow slowly until puddle is again clear. Gas-flow at this point is minimum allowable.

If the welding process is automatic, flow should be 10% higher than the minimum, and 15% higher if welding is manual. These higher flow rates allow a margin of error in nozzle-to-work distance or drafts. However, quality control tests (X-ray, tensile strength, corrosion) must still be considered when determining the minimum requirements.

Once the flow rate for a particular job has been determined, considerable savings, previously not available, can be obtained.

*Mr. Tuthill is assistant manager of Airco's development department.





Mig spot welder

CP-C-OManual welding package now features a button weld attachment suitable for metals from 0.035 to 0.187-in. thick. No special operator skill is needed to produce good welds with any one of the three nozzles: for vertical down, 45-deg inside tack, and 45-deg outside tack welding. Number of cycles can be varied from 3 (1/20 second) to 360 cycles (6 seconds). Arc is struck when wire touches work piece, and continues until time cycle ends.

Basic elements in the manual package: 600-amp constant power source, wire drive unit, and semiautomatic hand gun. Each unit comes with two feed rolls for driving $\frac{1}{16}$-in. diameter wire. Rolls for $\frac{3}{64}$, $\frac{5}{64}$ and $\frac{3}{32}$-in. rolls are available. Gun assembly is water cooled. *A. O. Smith Corp.*

Circle No. 1

Gageless regulators

Oxweld gageless regulators, it is claimed, eliminate annoying problem of gage breakage and replacement, and offer a great improvement in industrial gas regulation. These large-capacity, single-stage regulators have stem-type valves and a minimum of exposed parts. Manufacturer states they are especially valuable where rough handling and switching from cylinder to cylinder is encountered. Three models: R-550 (oxygen), R-551—(acetylene) and R-552 (propane) are available in these respective delivery pressures: 150, 15 and 15 psi. Delivery pressures are calibrated on anodized plate on cap of regulator and pressure is shown by indicator running in slot alongside calibrated reading. As pressure adjusting screw is turned delivery indicator moves to desired pressure. *Linde Co.*

Circle No. 2

Metal removal torch

Push-button air control valve in handle is said to make this size metal-removal torch more convenient than formerly. Model H-5 is useful in foundries, plate fabricating shops, and heavy maintenance work. A wide range of electrode sizes, up to $\frac{5}{8}$-in., may be used. Power connection on concentric cable assembly is covered with rubber boot to prevent accidental arcing. Process uses electric arc to melt metal simultaneously with air jet to remove molten metal. Consumable electrodes are copper plated and of a carbon-graphite formula. Only auxiliary requirements are welding machine and 80-100 psi of compressed air. *Arcair Co.*

Circle No. 3

E6012 electrode

This 12A electrode (E6012) has iron powder added to coating to increase deposition rate. Designed for high-speed production work on mild steel in flat, vertical and overhead positions, and for lap seam welds, it permits use of high welding currents, and reduces clean-up time. Works best on d-c, can also be used with a-c current. It is available in $\frac{1}{8}$ and $\frac{5}{32}$-in. diameters in 14-in. lengths, $\frac{3}{16}$-in. diameter in 15-in. length, and $\frac{7}{32}$, $\frac{1}{4}$ and $\frac{5}{16}$-in. diameters in 18-in. lengths. *Hobart Brothers Co.*

Circle No. 4

Electrode holder

Handi-Arc electrode holder has molded pistol grip with built-in safety cut-out which prevents accidental shocks. Current goes off instant grip is released. Manufacturer claims 15% saving in electrodes because of tip grip, permitting use down to a short stub. Holder has heavy duty milled copper jaws, adjustable to rods of different diameters, and a push-button stub ejector. Red case of electrode holder is high impact phenolic plastic. *Frank Niemi Metal Products, Inc.*

Circle No. 5

Portable pipe welder

Automatic circumferential welding machine for Mig, butt welding of aluminum pipe that operates with conventional engine driven d-c power source has been developed. Several sizes of the new machine weigh from 40 to 50 lbs so that they are easily portable. Unit is held in position by strap clamp so that welding gun and cable drum gear travel around horizontal axis of pipe. With this equipment, 4½-in. standard pipe can be butt-welded in less than a minute, without any programming. *Aluminium Ltd.*

Circle No. 6

Liquid flux device

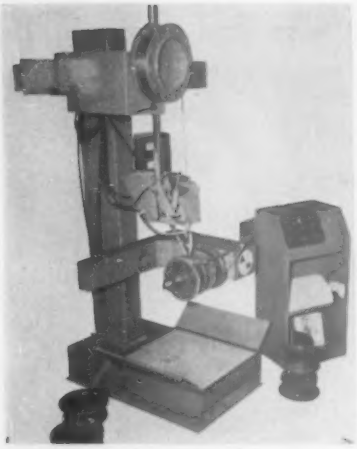
Rexarc Liquifluxer provides a steady flow of brazing flux without the use of wicks to clean and replace. No shutdowns are necessary, because a glance at non-clouding liquid level gage shows exact amount of flux in the fluxer. Rexarc Liquiflux is vaporized and inducted into gas stream automatically as required. No special torch is needed. No pre-cleaning is necessary, it is claimed, because flux in the flame cleans and fluxes parent metal for brazing. Liquiflux may be used for brazing non-ferrous metals to steel and iron. *Sight Feed Generator Co.*

Circle No. 7

Gas storage system

Liqua-guard system features a complete line of vacuum jacketed vessels, vaporizers and associated equipment to provide for storage, movement, and distribution of atmospheric gases in liquid form. Basic components are: customer stations (at user's site), semi-trailers, bulk storage units, delivery trucks, pumps and vaporizers. Advantages of this modern gas-handling system are said to be: 100% product volume delivery, no residual gas loss, elimination of many pressure gas cylinders. Other advantages claimed are reduction in *direct* labor costs, reduction of storage space, and elimination of high pressure regulators. *Cambridge Corp.*

Circle No. 8



Resurfacing welder

Automatic, self-contained welding unit is used to resurface track rollers, idlers, mining car wheels, etc. The Micromatic automatically adds a rebuilt surface that requires no machining and provides longer wear, according to manufacturer. Unit operates by submerged-arc principle. Yoke will handle parts up to 48-in. diameter and can be tilted 135 deg to handle flange rebuilding as well as circumferential resurfacing of concave, convex or flat objects. Automatic welding head, powered by variable-speed motor, provides accurate adjustment for depth and width of resurfacing metal. Flux-reclaiming unit is also available. *Automatic Welding Co.*

Circle No. 9

Tong test ammeter

Ammeter is intended for measuring direct current in one-half amp divisions, from 0 to 10 amp. In addition, type PB meter will read a-c and d-c currents up to 20 amp. Jaws will accommodate conductors up to ½-in. diameter. The 10-0-10 d-c scale utilizes an electrical zero, established by use of a magnetic source attached to instrument. *Columbia Electric Mfg. Co.*

Circle No. 10

Performance checkers

Two new transducers or transmitters serve to check welding machine performance. The first of these is designed for use with an oscilloscope or direct-writing recorder, and accommodates electrode holders from 1¼ to 1¾-in. diameters. Second instrument, primarily for use on gun-type resistance welders, registers tip-pressure and secondary welding currents simultaneously, on a double channel direct-writing oscillograph. Company can furnish either of these products for use with existing instrumentation, or can supply complete package instrumentation including the transducers. *Control Devices Inc.*

Circle No. 11

Tig weld machine

Company's Tig welder can also be used for arc welding. Units are available in 300 amp size, either as a straight a-c transformer welder, or as combination a-c/d-c rectifier welder. Saturable reactor type control is a part of all units. Among optional features are: high frequency kit for water, gas and high frequency arc intensity; remote hand or foot control for adjusting amperage; a d-c filter; and power factor correction condensers. *Lincoln Electric Co.*

Circle No. 12

Plastic metal filler

Shurbond, it is claimed, is non-toxic, contains no dust or fibreglass and requires no special tools for application. Reinforced for use on auto bodies, tanks and sheet metal dents, the product fills dents, crevices and holes in a single application. Available in half-pint, quart and gallon cans. *Anchor Metal Co., Inc.*

Circle No. 13

Belt grinders

Complete line of 2½-in. belt grinders is said to fill need for low-cost machines to do fast grinding, buffing and deburring. Standard equipment includes: arbor head, rubber contact wheel, 2¾-in. backstand idler unit and abrasive belt. Belt speed is 5,400 fpm with 6-in. contact roll using standard 1725 motor. *Walker-Turner Div. Rockwell Manufacturing Co.*

Circle No. 14

Mig welding wire

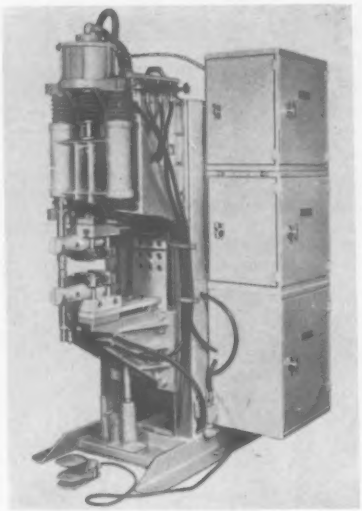
Inco filler wires for Mig welding are now available on 2-lb spools. A variety of filler wires can be attached directly to Mig guns for easy handling, and to cut welding time. These wires are now available: Inco-Weld "A", No. 67 70/30 copper-nickel, No. 62 Inconel, No. 61 nickel, No. 60 Monel filler wires. *International Nickel Co.*

Circle No. 15

Safety glasses

Company says that styling and safety are twin features of Series 711 plastic-frame safety glasses. Duo-tone glasses come in two types of temples: broad spatula style, and cable style with permanent vinyl coating. Line also provides standard S-7 square lens shape, interchangeable with present safety glasses. *Sellstrom Manufacturing Co.*

Circle No. 16



Single-phase welders

Line of resistance-type welders features exclusive lineal ball bearing sleeve on all models. Manufacturer claims new precision and economy in high speed welding. Light metal rams are employed instead of heavy metal castings to help reduce inertia and facilitate quick response. Neoprene cylinder rings are used, pull-in instead of push-in rams, and a Heat-Vector control of up and down slope of welding current. All new air-actuated models include: single and double-ram press type spot and projection welders (5 to 250 kva), fully and semiautomatic butt welders (5 to 100 kva), press-type bench welders (5 to 50 kva). Also available are air-actuated and foot-operated rocker arm spot welders (10 to 75 kva capacity). *Electric Arc, Inc.*

Circle No. 17

Fittings and flanges

Pipe-Mate line of stainless steel fittings and flanges is stocked in ½-in. to 4-in. sizes, schedule 5S and 10S. Best suited to corrosive applications in area of 150 psi or less, their special feature is a carbon-steel swivel-type insert flange designed for ease of alignment. It has stainless-steel insert at bore into which pipe or fitting can be expanded, without welding. Reversible fitting, Plug-R-Cap, may be butt welded in regular position, or fillet welded in reverse to act as plug or pipe closure. Line also includes elbows, returns, tees, crosses, reducers, etc. *Tube Turns.*

Circle No. 18

Spot-welding tip holders

New design ejector-type spotwelding tip holders are now a part of the Tuffaloy resistance welding line. Two major parts, a plated copper-alloy barrel and a brass head carrying water hose connectors, are held together by a coupling. An ejector tube at-

tached to head ejects welding tip when entire head is forced to slide into barrel. Known as Series E holders, they are made in 8 and 12-in. barrel lengths. Diameters are 1, 1¼ and 1½-in. sizes, and hold Nos. 1 and 2 Morse taper tips. *Air Reduction Sales Co.*

Circle No. 19

Goggle cleaner

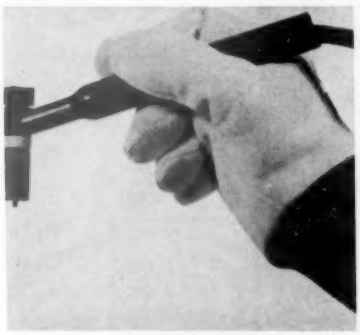
Goggle-cleaning station consists of metal cabinet that dispenses fresh tissues and Fogpruf lens-cleaning liquid from unbreakable polyethylene squeeze bottle. Fluid contains cleaning and anti-fogging agent that coats lens surface with micro-thin protective film. Cabinet is 6-in. high, 5¼-in. wide and 6-in. deep. All-metal cabinet has 200-sheet capacity. *Mine Safety Appliances Co.*

Circle No. 20

Plastic headgear

Huntsman welding headgear is made from Marlex rigid polyethylene that conforms to shape of wearer's head. It has locking knob adjustment that helps position filter plate in direct line of vision when welding. Remains comfortable regardless of temperature, says manufacturer, and may be sterilized in boiling water. *Kedman Co.*

Circle No. 21

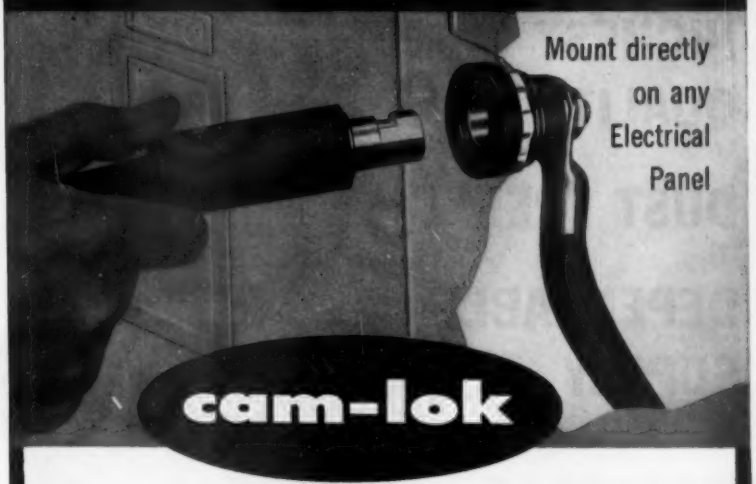


Tig torch

Heliarc torch is 6⅞-in long, but can carry 200 amp on continuous duty cycles. Model HW-20 is for manual Tig welding. Said to have excellent water-cooled design, torch is as easy to use as a pencil. Torch weighs 3.6 oz and operates on currents up to 225 amp on reduced duty cycles. Available as accessory is argon gas shutoff valve. *Linde Co.*

Circle No. 22

New Hi-Impact Plastic Insulated
Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast
direct mounting on . . .

• ELECTRICAL DISTRIBUTION PANELS • SWITCHGEAR
• BUS DUCT • JUNCTION BOXES
• WIREWAY or any electrical cubicle

A Complete Line of Welding Accessories and Special Power Distribution Connections

cam-lok
DIVISION

EMPIRE PRODUCTS, INC.
P.O. BOX N-98
CINCINNATI 36, OHIO

NATIONAL CARBIDE
IN THE RED DRUM

HIGHEST QUALITY

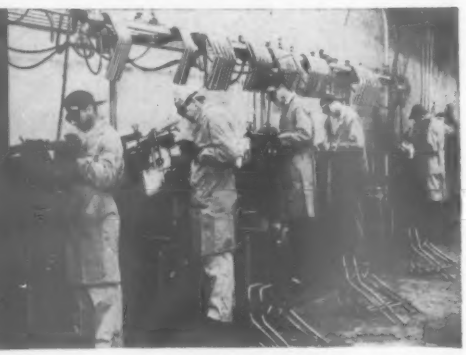
DUST FREE

DEPENDABLE SUPPLY

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company
A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED
GENERAL OFFICES: 150 EAST 42ND STREET, NEW YORK 17, N. Y.
AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

TOP QUALITY
FLUXES
made by All-State for
WELDING
BRAZING
SOLDERING



Production line brazing with automatic fluxing system. Information on All-State JET FLUX® on request.

POWDERED flux is micro-ground;
PASTE flux is homogenized

At ALL-STATE each flux is manufactured to rigid specifications, tailored for best results with specific alloys. For example, ALL-STATE's S-200 silver brazing flux affords complete protection to heated base metal to 1800° F., insuring excellent capillary action and easy flowing of silver alloy. Melts at 600° F. Equal care is built into other fluxes made by ALL-STATE to assure oxide-free bonding of all metals at low temperatures.

Ask for free copy of 58-page Instruction Manual. Write for information on fluxes custom coated on your own rods.

All-State
Distributor Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

Safety headgear

New line of fibre-glass, aluminum and plastic electrical safety hats and caps features a polyethylene suspension, which assures a 1¼-in. clearance between crown and hat shell. Another feature is plastic-zippered leather sweatband which can be quickly replaced, without disturbing the suspension. All three lines are resistant to moisture corrosion and exceed federal standards for hard hat safety. *Boyer-Campbell Safety Div.*

Circle No. 23

Hardfacing electrode

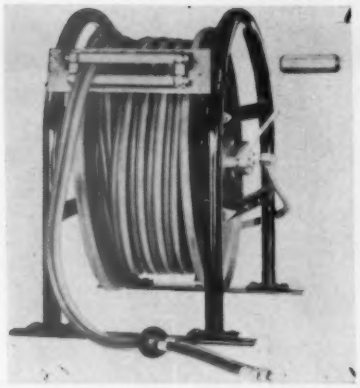
Stoody 2134 is a high-alloy hardfacing electrode with high resistance to extreme abrasion, medium impact and high compressive loads. Manufacturer says this tubular electrode provides service life surpassed only by tungsten carbides. It has dipped graphitic coating containing 43% alloy materials. Deposits will bond to carbon, low alloy and manganese steels. Rod has excellent arc characteristics on a-c and d-c, straight or reverse polarity. Hardness ranges from 56 to 60 Rockwell C with a two-pass deposit on medium carbon steel. Available in 5/32 and 3/16-in. diameters in the 14-in. length; ¼ and 5/16-in. in 18-in. length. For semiautomatic welding a 7/64-in. diameter wire is available in 50 lb coils. *Stoody Co.*

Circle No. 24

Inspection lamp

An inspection lamp for use in detecting harmful foreign objects in liquid and gaseous oxygen equipment is said to cut inspection time. Use of the ultra-violet lamp makes such elements as flux, lint, hydrocarbons, petroleum base oils, etc., plainly visible. *Ultra-Violet Products Inc.*

Circle No. 25



Hose reel

Hand operated reel has 150-ft capacity of ¼-in. dual hose. Model OA-10 has hand crank for reeling hose. An adjustable drag brake permits control when paying out hose. When reeling-in, sprocket and chain drive gives extra power to crank. Finished in baked-on enamel. *United Specialties Inc.*

Circle No. 26

Cutting machine

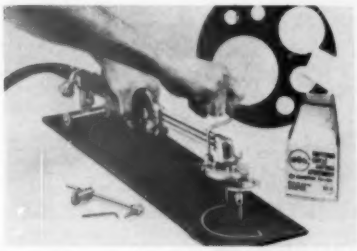
Little Blacksmith No. 56 has a 6½-ton capacity, and may be used for shearing, cutting, notching and punching operations. It operates on a 100-lb air line pressure and weighs 225 lbs. Shears 3-in. by 3/16-in. bars; punches holes 5/16 through ¼-in. sizes (2-in. through 16-in. gage). Notch or cut-off is 2 by 2-in. by 3/16-in. angle. Depth of throat is 2½ in. *J. F. Kidder Manufacturing Co., Inc.*

Circle No. 27

Induction heater

Model L4E-C-2 induction heating generator is adaptable to these operations: relining and growing of semi-conductor material, inert-atmosphere brazing of precision and nuclear components, high temperature analysis of rare earths and metals. Machine is available at any specified frequency, range of 200 kc to 3 mc. Has two-station output with manually operated safety interlocked transfer switch. *Reeve Electronics, Inc.*

Circle No. 28



Circle-cutting device

OR-O-CO attaches to any oxyacetylene cutting torch and permits cutting of precision holes in thick metal plate. Circular discs, squares, rectangles and odd shapes ranging from ½-in. to over 12-in. in diameter can be cut by merely turning a crank. Lightweight and small in size, this tool will operate in confined spaces, and eliminates the need for expensive free-hand cutting. *OR-O-CO Tool Co.*

Circle No. 29

Tempilstik°

*temperature indicating crayons**

**Also Tempil° Pellets and Tempilaq° (liquid form)*

***Tempilstik°*—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating — as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.**

Send for *free* sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

WELDING SALES DIVISION

***Tempil°* CORPORATION • 132 West 22nd St., New York 11, N.Y.**

WORN TRACTOR PARTS

last longer when rebuilt with

MANGANAL®

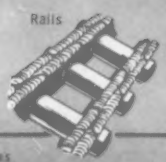
11%-13½% MANGANESE-NICKEL STEEL

APPLICATOR BARS & WELDING ELECTRODES

- Manganal deposits smooth-in to fit opposing parts.
- Extreme toughness prevents chipping or spalling.
- Cost less and outlast new parts

Sprockets

Dozer Blades


Rails

Rollers

Idlers

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

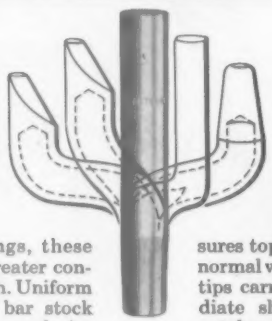
SOLE PRODUCERS

STULZ-SICKLES CO.

929 JULIA STREET • ELIZABETH, NEW JERSEY

WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

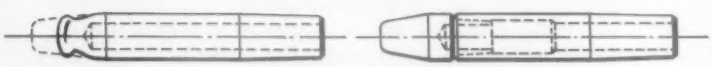
Are You Yet Using Cast Tips?



TUFFALOY
Cold-Formed Tips Are The Answer

Compared to castings, these Tuffaloy tips show greater conductivity and strength. Uniform high quality of the bar stock from which they are made insures top performance under all normal welding pressures. Many tips carried in stock for immediate shipment. See Tuffaloy catalog for this wide selection.

TUFFALOY® Spotwelding Tips



Are You Throwing Away 90% of Worn, Mushroomed Tips?

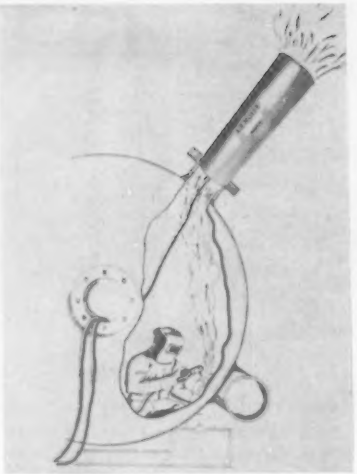
With Tuffcap®, You Replace Small Tip only, Re-use Shank

With care Tuffcap shanks outlast many Tuffcap tips, interchangeable in four standard nose designs. Tips are easily replaced, reducing holder wear and down-time of machine.

Tuffaloy resistance welding alloy products are widely available through Airco and Tuffaloy representatives. Call on them for SPOTWELDING TIPS (Standard, 'Tuffcap', Cold-Bent, and Special), Holders and Adapters, BAR STOCK, FORGINGS, SEAM WELDING WHEELS, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO®

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.



Fume exhauster

Air Mover is an inexpensive, uncomplicated device for exhausting welding fumes from closed work areas. Powered by compressed air from the shop line, it uses a modified venturi principle to remove smoke, fumes and hot air. No fans or motors are necessary. Operation simply requires connecting it to the air line and positioning at an opening of the vessel in which welding is being done. *The Arcair Co.*

Circle No. 30

Hard alloy strip

Extruded hard-alloy wear strip rectangles in 23 new sizes are now available. They are extruded from continu-cast billets of Ampco metal grade 21, which is recommended for severe metal-to-metal wear applications and extremely heavy loads. These rectangles are suited to automotive, machine tool and allied industries. *Ampco Metal, Inc.*

Circle No. 31

Gas analyzer

Test instrument VIGA 200, visual inert gas analyzer, provides a recorded test of the purity of argon and other inert gases used in brazing structural assemblies and in high Tig welding. Heated titanium strips in heater element chamber react instantly to contaminants as gas passes across them. Unit automatically cools heater element as a test is completed, so that titanium strips may be removed and handled immediately. *Pioneer Industries Div.*

Circle No. 32

SAFETY SAM says:

Tig welding package

Tigpak is a portable, Tig welding unit connected only by the usual welding cables. Developed for remote location use with a-c/d-c gasoline engine welders of 200 or 300-amp capacity, it can also be used with d-c gas driven welders if a source of 110-volt a-c power is available. Special adapter kit makes the unit operable also with d-c, a-c or a-c/d-c motor generator sets, rectifiers or transformers. *Hobart Bros. Co.*

Circle No. 33

Stop-off liquid

Nicrobraz Red Stop-Off is a new liquid applicable to furnace brazing only. It acts as barrier to molten brazing alloys by preventing capillary action needed for proper flow. Can be applied by brushing, dipping or spraying. Chemically inert at elevated temperatures, it will not contaminate furnace atmosphere. Designed for easy removal, liquid is well suited for use on fine threads, wire screens etc. *Wall Colmonoy Corp.*

Circle No. 34

Regulator sizes reduced

Inductrol induction voltage regulators have been reduced in size and weight. Single-phase ratings have been cut an average of 15% in weight. Weights on three-phase units have been trimmed from 15 to 50%. Dimensions have also been reduced throughout the line. Reductions have been achieved without loss in reliability or service life of units, says manufacturer. *General Electric Co.*

Circle No. 35

Tube bender

Completely automated bending machine is adaptable to variety of production tube bending jobs. Button is pressed and bender feeds tubes into position, bends them, and removes bent tubing without attendance other than keeping inlet hopper supplying tubes. Two tubes can be processed during each machine operating cycle. Simple tooling changes provide versatility in type of bends. Flat back U's can be produced at 1800 bends per hour, conventional return bends at rate of 980 per hour. A sound alarm warns handlers 30 minutes or less before tube supply empties. *Wallace Supplies Manufacturing Co.*

Circle No. 36

KWIKFLUXER Unbreakable Plastic Squeeze Dispenser

Ends...

- MESSY BRUSHES
- STICKY FINGERS
- SLOPPY FLUX APPLICATIONS

- Ready for Use
- Fast & Economical
- Waste Free • Refillable

KWIKFLUX 54 Patented

FOR SILVER BRAZING AND HARD SOLDERING

Has double penetrating power and miracle flow. Protects work. Makes more complete brazes especially in those long, deep joints. Low flow point saves heating and brazing time. Unexcelled for joining all ferrous, non-ferrous and precious metal alloys. Proven best for brazing carbide tips and tools. Can be used with all types of heating applications . . . direct, indirect and induction heating. Greater protection saves cleaning time . . . speeds work . . . cuts costs!

The KWIKFLUXER Applicator Container is made of pliable plastic with screw cap tip, ready for use. Pierce tip, squeeze and apply to work. Small opening eliminates waste from rapid evaporation and hardening. It's quick, convenient and refillable.

KWIKFLUX No. 54 in the 12 oz. KWIKFLUXER Squeeze Dispenser, only $1.60 each.

If your welding supplier is out of stock, order direct and please include name of your supplier.

SPEC **SPECIAL CHEMICALS CORP.**
100 SOUTH WATER ST., OSSINING, N. Y.

BECKER *Keen-Cut* **Electrodes**

for use in CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity . . . longer life . . . shorter cutting time . . . greater material removal . . . smooth surface gouge . . . controllable accuracy . . . hot stable cutting arc . . . elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

BECKER BROTHERS CARBON CO.

3436 South Laramie Ave. • Cicero 50, Illinois

Telephone: BI 2-1260 • Chicago

SAFETY SAM says:

"I always use Dockson GOGGLES they give me more protection and comfort!"

MODEL 96 GOGGLES

MODEL 40 SPECTACLES

MODEL 492 GOGGLES

There is a Dockson goggle or spectacle to meet any requirement. Low cost, high quality equipment, "Built for better protection." Scientifically designed for safety with maximum comfort. Many outstanding features and careful construction usually found only in higher priced equipment. You'll like 'em!

Write for our Head & Eye Protection Catalog and name of your distributor.

3839 Wabash Dockson CORPORATION Detroit 8, Mich.

Save and be sure with ENGWALD

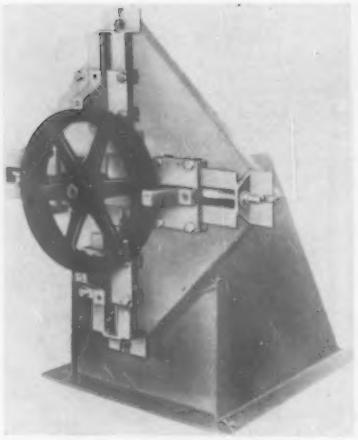
Welding fume exhausters

- Systems have been approved for Government Health Depts. in U. S. & Canada.
- Guaranteed for highest efficiency.
- Portable & Stationary units for all applications.
- Unlimited flexibility; fast, easy positioning over 360°.
- Blowers attachable to units or mounted at remote points.
- Units can be connected in series.
- Available in 9, 12 or 15-ft. reach units.
- Complete installation can be easily done by your own men.
- Engwald Exhausters come complete with mounting brackets.

WRITE FOR NEW CATALOG WE-6

ENGWALD CORP.

125 Sheridan Blvd., Inwood, L.I., N. Y. • FRanklin 1-2222



Clamping fixture

Standard clamping fixture for welding positioners, Quickset Jaws, reduces set-up-time and increases job safety. Jaws fit all positioner face plates, tilt tables, and head or tailstocks, and come in four sizes: 2,000-lb to 30,000-lb capacities. *Worthington Corp.*

Circle No. 37

Starting control

Automatic engine starting control is for starting and stopping of engine-driven generating sets. It prevents recranking at full engine speeds; responds at 50% of normal battery voltage; operates over broad ambient temperature range. It has panel which provides continuous cranking cycles. Unit has industrial control type components throughout; operates from single pole contact on the automatic transfer switch or control station. *Automatic Switch Co.*

Circle No. 38

Low-alloy wire

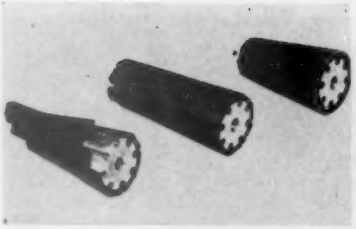
Especially designed for CO_2 welding, Page A-S-18 welding wire, when used with suitable deoxidizers, will scavenge the weld metal of all impurities and residual gases causing porosity. Tests of this wire as submerged arc electrode have yielded tensile strengths of 114,000/120,000 psi, and elongations of 20 to 25%. This was while using a neutral or slightly manganese-additive flux. *American Chain & Cable Co. Inc.*

Circle No. 39

Coaxial cable

Flexible coaxial cable now permits application of high frequency induction heating techniques in areas said to be previously inaccessible. Cable attaches to an induction heater at one end and to work coil at other. Available in lengths from 2 to 20 ft; two connected maximum-lengths may also be used. All leads for the circulating water are enclosed within self-contained cable. Some applications for this cable are spot brazing of honeycomb structures, spot annealing of titanium, local forming, etc. *L. C. Miller Co.*

Circle No. 40



Abrasive cone

Flexcone is a new expanding-type abrasive cone designed to eleminate abrasive waste. It consists of machined aluminum core with individual rubber flexers at periphery. When cone is at rest flexers lie flat, permitting easy removal of abrasive sleeve. When in motion, the flexers expand and grip abrasive to prevent slipping, regardless of way cone is moved across work piece. Individual flexers are replaceable. *Nu-Matic Grinders, Inc.*

Circle No. 41

Cam index drives

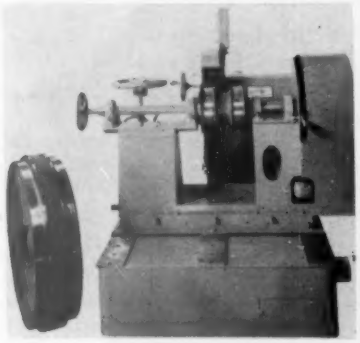
Standard cam index drives are said to provide smooth, accurate and shock-free indexing of both trunnion and dial type index tables on automated machines and special machine tools. Three drives are available for table sizes from 20 to 100 in. in diameter. Special models can be produced for any size index table. *Expert Automation Machine Co.*

Circle No. 42

Welding screens

Five different types of Flash Shield welding screens are made with aluminum frames. Available are single, double and triple panel shields, as well as a raulti-panel and a completely covered booth-style. Olive drab 12-oz. cover material is employed. All shields fold compactly for handling and storage. *A. O Lundberg & Sons, Inc.*

Circle No. 43



Finish grinder

Model RG-2 is designed for finishing crawler tractor rollers and idlers. Machine can handle any size roller and idler. It has a cross feed for moving the faces across grinding wheel surface, built-in dust fan and collector, a 1-hp motor and optimount for rotating the rollers, as well as special grinding stone. Grinding wheel is driven by 15-hp motor. *L and B Welding Equipment, Inc.*

Circle No. 44

Eliminates Spatter Grinding After Welding

YORK'S *SPAT-R-PRUF* COMPOUND 106

THREE *EASY* STEPS

1. Coat Surface
2. Weld
3. Wipe Off

A perfect paint base. No stirring or dilution necessary. No grinding after welding—spatter can be wiped away with a dry cloth.

IMPORTANT FEATURES

- Non Toxic
- Non Inflammable
- Pleasing Odor
- Harmless to Skin
- Helps Prevent Rust
- No Weld Porosity

Available in 1 gallon cans and 5 gallon cans and 55 gallon drums.

3-IN-1 YORK'S '77' SPECIAL FLUX

- For General Brazing
- For Cast Iron Welding
- For Cast Iron Brazing

A guaranteed bond even under toughest conditions
Available: 1 lb. Cans

YORK ENGINEERING COMPANY
2711 S. KEDZIE AVENUE • CHICAGO 23, ILLINOIS

ANNOUNCING!

A NEW METHOD Of Connecting Welding Cable

T.P.C.* Pat. Pending

***THREADED POWER CONNECTION**

Trim insulation — allow ¼" to extend through sleeve

Slip on threaded sleeve

Crimp sleeve with Swedg-on tool

ASK YOUR **HI-AMP** DISTRIBUTOR TO EXPLAIN THIS NEW—EASILY ATTACHED— COOL RUNNING CONNECTION

Lenco, Inc. P.O. Box 189 Jackson, Mo.

minum CMC Transcretes are the result of several years of joint development work by Kaiser Aluminum & Chemical Corp. engineers and personnel of Construction Machinery Co.

Built of weldable alloy 5086, developed by Kaiser Aluminum, the CMC Transcretes weigh ⅓ less than steel models of the same size. All parts are aluminum except the drive train and mixer controls.

Aluminium Ltd. to open New Zealand plant

A new aluminum fabricating facility in New Zealand will be operated as a branch of the fully-owned British subsidiary, Northern Aluminium Co. Ltd.

The plant is planned to provide most of New Zealand's requirements of semi-fabricated products, and allow for expansion in other fields. Primary aluminum for the operation will be supplied by the company's Canadian smelters. T. E. L. Ashley has been appointed branch manager.

Superior purchases Gerow Propane Ltd.

Superior Propane Ltd., Toronto, has bought out Gerow Propane Ltd., Brockville, Ontario. The purchase involves cylinders, regulators, and a transport tanker. Gerow customers are being serviced by Superior.

Latest advances in welding discussed at AWS meeting

Modern techniques and equipment for the welding industry were discussed and exhibited at the recent American Welding Society's 40th Annual National Welding Meeting and Seventh Annual Welding Show in Chicago. (See pages 56 and 57 for more meeting and show coverage.)

Missiles and their fabrication were a highlight of the meeting, as they seem to be of all recent technical gatherings. D. M. Daley, Jr., of the Army Ballistic Missile Agency, told one group that missile fabrication such as used on the Jupiter IRBM requires maximum weld quality and weld joint efficiency.

To obtain this, he said, care must be taken to use proper material cleaning techniques, to provide optimum welding conditions and adequate tooling and fixturing. Experiments conducted by Army researchers have proved the need for mechanically clean joints for good fusion welds.

Of prime importance is the controlling of weld conditions. Fully automatic welding is preferred, it providing fusion welds with tensile properties 10% or more greater than those accomplished with manual welding.

Other experiments have shown that the best mechanical properties are obtained through use of Tig welding rather than Mig.

All experiments were made on the aluminum-magnesium alloy used in missile fabrication. The alloys were experimented with, too, and proved to have tensile strengths comparable to those of other alloys, while being more ductile.

Ship welds will soon be inspected with gamma rays without using X-ray films, reported J. I. Bujes, U. S. Naval Ordnance Station.

In the new method, cobalt 60 is used as a source of gamma rays in conjunction with a radiation detector. The source is moved along the weld, while the detector tells when defects are spotted. Experiments showed scintillators to be the best detectors, and the weld itself the best back scatter.

Though still in the experimental stage, it is estimated that with a 10-curies cobalt 60 source, a straight ship weld 1-in. thick and 1,000-ft long can be tested in 11-hours.

"By transferring electric energy into heat in accurately restricted zones of glass or ceramic to be processed, operations can be performed with a precision and reproducibility unknown to early glass workers," E. M. Guyer, Corning Glass Works, told one session.

High frequency and 60-cycle conduction heating are widely used to process glass, but they complicate the operation of welding machines.

Electric arcs were tried, but they either boiled or stained the glass. Corning, in an attempt to overcome these difficulties, found a way to weld glass and ceramics without injuring the heated surfaces. They did it by using high-voltage electric arcs travelling in properly oriented magnetic fields, over suitable arc-runners encircling the parts to be joined.

Wire identification

DESIGNED to end costly wire mixups for any user, each coil of this automatic welding wire has grade stamped on side of liner to insure instant identification. Coils are made by Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa.

Distributors for K-G get novel sales training

Distributor salesmen for the K-G Equipment Co., Allentown, Pa., are going to school again, in fact, right in their own living rooms. The subject matter is conveyed by a 15-minute phonograph record and covers the company's compressed gas pressure regulator line.

Part of the record gives a step-by-step disassembly and reassembly of a regulator, while the listener works with a stock K-G regulator.

US Steel expands National Tube capacity

A building expansion program was recently begun, which will nearly double the stainless steel tubing capacity of United States Steel's National Tube Div. works at Ellwood City, Pa.

The new structures, of rigid frame steel construction, will add approximately 40,000-sq-ft of manufacturing space. During the expected 18 month construction period, production of tubing will continue on present facilities.

1960 IAA convention set for San Francisco

The International Acetylene Association Board of Directors has voted on San Francisco as the 1960 convention site. All sessions will be held in the Hotel St. Francis, May 9-10.

J. B. KERR, back to camera, of Reynolds Metals Co., Atlanta, demonstrates some up-to-date color anodizing techniques to group of observers.

Welding seminar highlights Reynolds plant dedication

An all-day welding and finishing seminar marked the recent dedication of the new Reynolds Aluminum Supply Co. plant at Louisville.

On the spot demonstrations of latest arc, Tig and stud welding equipment, as well as arc cutting and color anodizing methods, were conducted by Graham Mfg. Co., Oak Park, Mich.; Air Reduction Sales Co., New York City; Linde Co., New York City; the Nelson Stud Welding Div. of Gregory Industries, Lorain, O.; and Reynolds Metals Co.

The first seminar of its kind ever staged in Louisville, the event drew observers from Indianapolis, Cincinnati, the Universities of Louisville and Kentucky, and from the Louisville Board of Education.

New aluminum tube source for furniture makers

Kaiser Aluminum & Chemical Sales Inc., Oakland, Cal., has made contractual arrangements with General Tube Co., of Torrance, a subsidiary of General Aluminum Corp., for the manufacture of welded aluminum furniture tube, which Kaiser will sell in the West.

The tube will be made from Kaiser Aluminum coiled sheet or from re-roll, stock-rolled and slit at General Tube.

Buffalo distributor expands its facilities

National Welding Supply Co., Buffalo, N. Y., has opened expanded facilities at 674 Swan St. The former location was 396 Ludington St.

Airline Welding building new plant

Airline Welding & Engineering Co. has broken ground for a 38,000-sq-ft plant in Gardena, Calif. The firm is presently situated in Hawthorne, Calif. The groundbreaking marks the beginning of the firm's fourth expansion in the past three years.

Riegel

... the preferred glove among skilled welders

TOPS IN DOLLAR VALUE

CHOSEN BY SKILLED WELDERS for extra heat protection, greater finger dexterity, and all-around comfort. Horsehide and "Flextan" leathers stay soft after dry-cleaning. Exposed seams completely welted. Seamless backs.

CHOSEN BY EXPERIENCED BUYERS for soft, sure comfort, longer wearability, excellent price, and quick acceptance in the plant... backed by Riegel's ready service and quick delivery.

COMPLETE LINE for any welding need. Let Riegel's specialists help match the right glove to the job. Ask for free catalog.

GENUINE HORSEHIDE PALM No. 956
Horsehide Palm, clute pattern cut extra long to prevent wrist chafing, and fourchetted for extra comfort and dexterity. Welted and wool-lined for complete protection.

HEAVY WELDER No. 997
Top quality green "Flextan", lined for heavy, hot jobs.

WELDERS MITTEN No. 987
Green "Flextan" leather, excellent protection, flexibility of finger movement.

SPOT WELDER No. 897
For lighter jobs, unlined green "Flextan" leather.

RIEGEL TEXTILE CORPORATION • Conover, N. C.

the best things come in small packages

. . . for example, consider the **new, improved** H&M Model "O" — the first pipe cutting and beveling machine especially designed for work on small diameter pipe.

The **new** Model "O", 7½ pounds of precision equipment, makes fast work of cutting and beveling 1½" to 4" pipe. One operator can easily handle this versatile unit, and completely perfect bevels are assured from the moment the torch is fired up . . . even with non-skilled operators.

H&M PIPE BEVELING MACHINE CO.

Trademark Reg

The Model "O" is just one of seven H&M machines designed to meet your pipe cutting and beveling needs on 1½" to 36" pipe. Write for illustrated catalog and specification sheets.

The Model "O" features fast, easy mounting. Quick operating snap-chain fasteners make it possible to move the machine in a matter of seconds.

Pat. No. 2813342

311 EAST THIRD ST. Diamond 3-0241
TULSA, OKLAHOMA

"Red Head" EXTRA HEAVY... LIFTING CLAMPS

- Variable lifting positions provided by three lifting holes.

Concealed threads add years to clamp life. Special design protects threads against spatter and damage.

- Rugged clamp body cut from 2" thick plate.

DESIGNED FOR LIFTING

■ All "Red Head" Lifting Clamps are designed from actual experience, to provide efficiency and long life. Built to take abuse, they provide long and trouble-free service.

Write for Complete Details

CHICAGO BOILER CO.

1969 CLYBOURN AVE. • CHICAGO 14, ILLINOIS

Never before! the FIRST truly REVERSIBLE Welder's Glove

NO exposed seams on EITHER SIDE!

PERFECT FIT on EITHER HAND!

FRONT and BACK LOOK ALIKE

PACKED SINGLY

Buy 3 instead of a pair. Can outlast 2 or 3 pairs.

It took 8 long years to design and perfect this truly interchangeable glove. Finest quality HORSEHIDE full fleece lined. Ask your dealer or write us.

SO DIFFERENT It's PATENTED! (U.S. patent No. 2,617,109)

16 PAGE CATALOG

Complete line of work gloves, welding gloves and safety clothing.

SINGER GLOVE MFG. CO.

860 W. Weed St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DIRECTORY

New market target plan for GE distributors

A strong bid for the industrial receiving and power tube business is being made by General Electric Co.'s Receiving Tube Dept., Owensboro, Ky. Under this 1959 Market Target Plan all government bid requests for tubes less than $500 will be referred to independent distributors.

In addition, all orders from equipment manufacturers for less than 100 receiving tubes of any one type, are being billed at prices in excess of distributor cost. This new plan also includes a complete promotion kit for distributor salesmen working on industrial user accounts.

NEMA issues new manual for school use

The Arc Welding Section of the National Electrical Manufacturers Association has issued a new welding manual designed for schools, colleges, and apprenticeship training courses.

Entitled "Arc Welded Joints—Strength of Joints—The Processes," it is now available through NEMA and the American Welding Society, 33 West 39th St., New York 18, N. Y. The cost is 25 cents per copy.

Ampco Metal names licensee foundry

A. W. Cadman Mfg. Co., Pittsburgh, has been appointed a licensee foundry by Ampco Metal Inc., Milwaukee, Wis. As Ampco's licensee, Cadman will produce castings from ingots of special copper-base alloys, under the trademarks Ampco and Ampcoloy.

4-D piping

ICE rink in $1,000,000 McHugh Forum on Boston College campus uses 4-D wrought iron piping. Self-fluxing action of 4-D pipe enables weldors to easily produce sound and durable welds.

Pipeline News

The Federal Power Commission has authorized Northern Natural Gas Co., Omaha, to increase its transmission capacity by 100,000,000 cu ft per day, at a cost of $15,956,500.

One delivery, to Northern Illinois, will involve 46 miles of main pipeline loops and an added 6,000 hp in compressor capacity. This project also includes an 18-mile extension. Northern's other application includes 57.4 miles of main line loop additions in Iowa, Nebraska and Kansas; plus 8,000 hp main line compressor additions in Kansas and Nebraska.

Texas Eastern Transmission Corp., Shreveport, has been authorized by FPC to construct facilities up to $4,000,000, to take natural gas from producers in its system in Texas, Louisiana, Mississippi and Illinois.

FPC authorization has been given to Columbia Gulf Transportation Co., Houston, to connect to its pipeline system new supplies of gas purchased by its affiliate, United Fuel Gas Co., Charleston, W. Va. Total cost is not to exceed $2,500,000.

Lone Star Gas Co., Dallas, has FPC authorization to construct and operate lines and field facilities to acquire gas purchased from producers within the area of its existing system in Texas and Oklahoma. Each single project is limited to $250,000, and the total cost to $1,000,000.

Distributor appointments

Harnischfeger Corp., Milwaukee: A. E. Bogg Machine & Tool Co., Jefferson City, Mo.; Texas Welding Supply Co., Dallas, Tex.

Adamas Carbide Corp., Kenilworth, N. J.: The Welles Supply Co. Inc., Elmira Heights, N. Y.

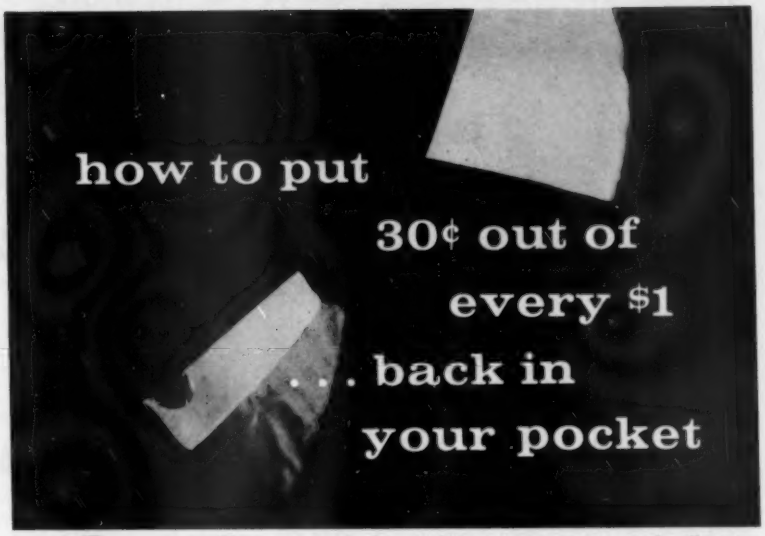
Guthery Machine Tool Corp., Long Island City, N. Y.: Essex Welding Equipment Co., Inc., Newark, N. J.

The Duro Engineering Co., Hamden, Conn.; Kenco, Cupertino, Cal.

United Specialties, Inc., El Dorado, Ark.: T. J. Maloney & Associates, Chicago; Floyd W. Davies, Cleveland; Edward M. Synan & Associates, Somerset, Mass.; J. W. Sableman, St. Louis; Walter Weyman Inc., Berkeley, Cal.; J. B. Milligan Co., Pittsburgh; W. H. Bolton Co., Dallas; Harold P. Ackerson Associates, Upper Darby, Pa.

Cambridge Corp., Lowell, Mass.; Coyne Cylinder Co., San Francisco.

Techline Div., Wheelabrator Corp., Vicksburg, Mich.: Carol Machine Tool Co., Ramsey, N. J.; Bauer Co., Fort Worth; Gene A. Castle, northern Indiana and northwest Ohio areas; Torrington Chemical & Supply Co., Torrington, Conn.



The answer is easy. You *get* 30% greater gas capacity in the all new Coyne 92 acetylene cylinder . . . you *save* 30% out of every *gas dollar* invested. Add to this the *lifetime* investment protection of a filler that will *not crack, settle,* or *separate* from the cylinder wall, and you can see why the 92 is the *greatest advancement* in acetylene cylinder manufacture in 40 years.

Get your copy now of the 92 bulletin . . . it gives the details. Write, or call collect the nearest office.

COYNE *cylinder company*

224 RYAN WAY, SO. SAN FRANCISCO, CALIFORNIA • PLAZA 6-6910
155 WEST BODLEY AVE., MEMPHIS, TENNESSEE • WHITEHALL 8-7788
3800 SPRINGDALE AVE., GLENVIEW, ILLINOIS • PARK 4-3828
24 COMMERCE STREET, NEWARK, NEW JERSEY • MITCHELL 2-1618

No Other Product Can Do a Galvanizing Job Like

Galvalloy

Does - *HERE'S PROOF*

Heat welded seam on galvanized sheet to 600° with Torch
Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.
3880 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.
Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

Hirschland

Mulder

Brown

Meunier

Clark

About people . . .

Metal & Thermit Corp., New York, recently elected *Herbert Hirschland* to the newly created post of vice president of the commercial development division. He has been associated with the firm throughout his career, in both sales and research.

Richard W. Torbert recently retired as manager, Engineering Service, Railroads, of Linde Co., New York, and is now living in Arroyo Hondo, New Mexico. He is recognized as a strong proponent of continuous welded rail.

Frank Pace, Jr., president of General Dynamics Corp. since 1957, has been elected board chairman; and former executive vice president *Earl D. Johnson* has been named president. At the same time three vice presidents were promoted. *Carleton Shugg* was made president of Electric Boat. *Dr. Frederic de Hoffmann* became chairman of the General Atomic division. *C. Rhoades MacBride* became senior operations vice president.

Whitehead Metals Inc., New York, has made a number of new organization assignments. *Edward W. Lothman* has been elected senior vice president. *Richard W. Nuffort* is now vice president and treasurer. *Casimir J. Bianowicz* was appointed general sales manager for all products of Inco Huntington Alloy Division. *Edmund L. Carey*, manager of Whitehead's New Jersey branch, was made secretary of the company; and *Frank A. Fink* has been appointed assistant to the vice president and assistant treasurer.

Babcock & Wilcox Tubular Products Division, Beaver Falls, Pa., has announced the appointment of *James S. Anderson* to general manager of the division. He had served as vice president in charge of sales since 1957.

John H. Mulder recently retired from the post of secretary of Miller Electric Mfg. Co., Inc., Appleton, Wis. He assumed this position in 1929, when the company incorporated. Mulder will continue to serve on the company's board of directors.

Westinghouse Electric Corp. has appointed *Fred D. Brown* marketing manager of its Arc Welding Dept. He had been manager of Westinghouse's Nuclear Ship Section. He will now be located at the Welding Dept's. main plant in Buffalo.

On May 6, *Dr. Augustus B. Kinzel*, vice president of research of Union Carbide Corp., was presented with the Stevens Institute of Technology Powder Metallurgy Medal. He will be remembered as a former IAA Morehead Medalist, also.

Edwin M. Miller and *G. E. Willis* were recently added to the current board of directors of The Lincoln Electric Co., Cleveland. Miller joined Lincoln in 1923, while Willis started with the firm in 1947.

Early in May, *George L. Stewart*, Indianapolis, was elected president of American Steel Warehouse Association for the coming year. Announcement was made at the organization's 50th annual meeting held in Chicago. Stewart is president of the Warehouse Div. of Jones & Laughlin Steel Corp.

On May 23, *Alexander Gobus*, product manager, Industrial Radiography Dept., Philips Electronics Inc., Mount Vernon, N. Y. received the Noah A. Kahn Memorial Award for 1959. Gobus is a charter member of the national Society for Non-Destructive Testing, and a past chairman of the Metropolitan Chapter, which made the award.

Fred A. Meunier recently joined Magnaflux Corp., Chicago, as senior engineer in the electronic engineering department. He will be responsible for the development of magnetic and eddy-current testing instruments for steel tubes and bars.

Albert J. Clark has begun work as district sales manager for Miller Electric Mfg. Co. Inc. His territory covers the northern three-quarters of Alabama, parts of Mississippi and North Carolina, and all of Tennessee.

Joseph T. Ryerson & Son Inc., Chicago, announces the appointment of *Ralph A. Castillo* as general manager of Ryerson's branch office at Houston, Tex.

In addition to present duties as assistant to the president, *J. G. Bollinger* has been appointed manager of production and distribution for Air Production Pacific Co., San Francisco. In addition, *Leland J. Fife* has been appointed manager of marketing, with headquarters in San Francisco.

Belden Mfg. Co., Chicago, has made several changes in their sales organization. *Wayne Hernly* is now district sales manager of the newly created Southeast Central district consisting of Indiana, Ohio, Kentucky, and parts of Illinois and Tennessee. *Gordon Shirreffs* will now concentrate on industrial accounts in portions of Illinois and Wisconsin. *Chuck Atwater* will handle industrial accounts in parts of Indiana and Kentucky.

Superweld Corp., North Hollywood, Cal. has announced the election of *Henry C. Diehl* as a member of their board of directors.

International Div., Hewitt-Robbins Inc., Stamford, Conn., has named *John J. Sheehan* to replace the retired *Harold von Thaden* as general manager.

Here's Why The *Famous*
KEY-BAK
Key-Reel
SAVES WELDERS TIME & MONEY

Retail $2.95

Welders who carry their flint-lighter on a KEY-BAK work **faster** . . . **save**, and make more money! Lighter is never lost. It's always handy at the welder's side, on his belt.

•

Get KEY-BAK for each welder. KEY-BAK is pocket-watch size, in highly polished chrome finish. Swedish clock spring reels in 24" long STAINLESS STEEL chain. LIFETIME GUARANTEE IN WRITING!

TWO MILLION KEY-BAKS NOW IN USE!

WELDER'S POUCH MODEL
Model 11-W designed especially for welders. Sturdy, genuine-leather pouch designed to hold chipping hammer and other tools. KEY-BAK attached to pouch. Pouch is worn on belt. Retails . . . $6.95

ASK YOUR JOBBER OR WRITE DIRECT!

West of Mississippi
LUMMIS MFG. COMPANY
2242 E. Foothill Blvd.
Pasadena, California

East of Mississippi
CTL COMPANY
1710 W. Stewart Ave.
Wausau, Wisconsin

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a **CONTOUR MARKER** — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

THE CONTOUR MARKER

A. J. McDonald, Jr. has been made sales manager of Welder's Supply Co., a subsidiary of Chemetron Corp., which serves Southern California.

William F. Schultz, a senior sales representative, has been transferred to the Woburn, Massachusetts office from Sylvania Electric parts division sales office at York, Pa.

Culver

Boericke

Douglas N. Culver has been appointed district sales manager, Los Angeles, of Hayes Stellite Co., Kokomo, Ind., a Division of Union Carbide Corp. He succeeds *Frederick S. Boericke*, now technical service manager, Pacific Coast, who had served as Los Angeles district sales manager since 1949.

Thomas A. Patterson, Jr. has been named advertising manager of Industrial Products Co., Philadelphia.

Milton Shapiro has been named manager of a new corporate Market Research Dept. of Vickers Inc., Detroit.

R. R. McBath has been appointed general manager of the Plainfield Div. of Worthington Corp., Harrison, N. J. He succeeds *K. W. Horsman* who has resigned. Worthington Corp. has also appointed *Charles D. Wood* as district office manager at Boston. He succeeds *Richard M. Cleveland*, who retires on June 30.

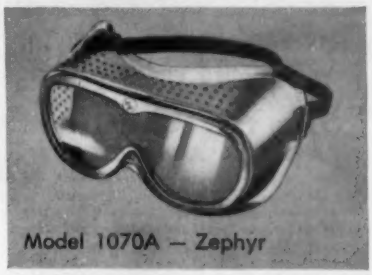
Mitchell Radiation Products Corp., Norristown, Pa., has announced that *Tolbert N. Richardson, Jr.* is now vice president and treasurer, and a member of the board.

Frederick G. Plett has been promoted to manufacturer superintendent of the semiconductor plant of Sylvania Electric Products Inc. located at Hillsboro, N. H. Since 1956, he had been supervisor of industrial engineering at Hillsboro.

J. G. Willis is manager of manufacturing of Blaw-Knox Co.'s equipment division in Blawnox, Pa. He is a member of the American Welding Society.

THE *NEW* VIEW FOR WELDERS!

WELSH sets the pace in creative design . . . new modern materials and techniques for your more effective eye protection.



Model 1070A — Zephyr

WELSH ZEPHYR — New, increased working visibility . . . greater top ventilation! The first major improvement since the origin of the soft-side. Choice of five ventilation styles.

Model 5070 — Cyclops

WELSH CYCLOPS — A one piece aperture welding goggle . . . soft side frame provides the ultimate in comfort, fit and visibility. Simplified lens holder permits easier changing of filter and cover plates.

Model 5050 — Soft-I

WELSH SOFT-I — Cushion-fit eye protection featuring unique, soft, pliable frame cover goggles. Deep cuts fit easily over largest prescription goggles.

WELSH — *Willingly Worn*
by Workers Everywhere

WELSH
MANUFACTURING COMPANY
9 MAGNOLIA STREET, PROVIDENCE, R. I.

Get the exact current for quality welding!

USE THE TONG-TEST AC-DC AMMETER

Don't assume your welders are using the right amperage. *Be certain* by controlling welding quality with the Columbia Tong Test AC-DC Ammeter, the only clamp-type instrument that measures both alternating and direct current. Snap tongs around the electrode cable for instant readings. Available in five types with interchangeable ranges up to 1000 amperes. Impossible to read wrong scale. No coils or wires to burn out—no electrical connections needed.

COLUMBIA

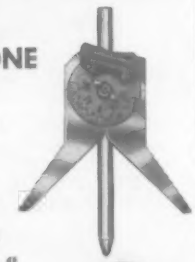
Write for illustrated 8-page Catalog WE-400

COLUMBIA ELECTRIC MFG. CO.
4551 Hamilton Avenue • Cleveland 14, Ohio

Really FIVE TOOLS in ONE

Yes, actually a BOYCE Centering Head replaces

- ✓ The Protractor
- ✓ The Centerhead
- ✓ The Center Punch
- ✓ The Level
- ✓ The Scale



Determines Center Line at any Degree and Measures Degree of Declivity

DIAL SET LEVEL

Weighs only 9 ozs. Pocket size.

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

BOYCE CENTERING HEAD

book reviews . . .

Welding handbook

WELDING HANDBOOK, (4th Edition, Section 2). Published by American Welding Society, New York, 1958. Fabricoid. 6 by 9 in., 550 pages. Price, $9.

The second section of *Welding Handbook* contains 13 chapters devoted to the welding processes.

Chapters written by acknowledged experts in the field cover such subjects as gas welding, gas pressure welding, gas welding and brazing equipment, shielded metal arc welding, bare metal arc welding, inert gas metal arc welding, submerged arc welding, arc welding equipment, spot seam projection welding, flash upset and percussion welding, and resistance welding equipment.

The last chapter covers standard welding symbols.

The second section of the *Welding Handbook* is essentially a continuation of volume one, published in 1957. Each chapter has a comprehensive bibliography and its own table of contents. In addition, there is an index covering all of the subjects in the book.

Plastic design

PLASTIC DESIGN IN STEEL. Published by American Institute of Steel Construction, Inc., New York, 1959. Cloth, 8½ by 11 in., 104 pages. Price, $4.

Here is a long awaited manual on a new structural design method which should give welding an important boost with structural engineers. This practical reference for professional engineers is concerned with the design of one and two-story continuous structures.

Plastic design is a new method based on knowledge of the behavior of continuous steel structures under loads beyond the yield point. Extensive testing in this country and Great Britain show savings of 15 to 20% in the quantity of steel needed for plastic design structures as compared to those based on elastic analysis.

Chapter on analysis describes the equilibrium method for designing continuous beam and single span, single story rigid frame structures.

There are separate chapters on the design of continuous and single span, and multiple span frames.

Careful attention is given to design detail and connections, including column design, connection, lateral bracing and unsymmetrical sections. To facilitate the designer's work, the book also contains a number of charts and formulas covering continuous beam and single and multi-span rigid frames.

Rules for plastic design and fabrication adopted by AISC are included. The various design examples used conform to these rules and to AISC specifications for the design, fabrication and erection of structural steel for buildings.

Hobby shop

ARC WELDED PROJECTS FOR THE SCHOOL SHOP. By William A. Sellon. Published by The James F. Lincoln Arc Welding Foundation, Cleveland, 1958. Paper, 8½ by 11 in. Price, 50c.

This is a book ideally suited for the hobby weldor or the school industrial arts department. It presents information about making 25 useful items, ranging from a foot scraper to a table saw.

Each of these has been constructed and is pictured with construction suggestions, detailed plans, and a bill of materials.

Included are table lamps, basketball goal, outdoor drink stand, floor lamp, post lamp, coffee table, TV stand, mail box, hose cart, ice fishing equipment, portable grill, bench shears, etc.

To add to book's value, there is included a bibliography of several hundred possible arc welding projects that have appeared in various publications since 1947.

Maintenance tips

MAINTENANCE HINTS. Published by Westinghouse Electric Corp., Pittsburgh, 1959. Leatherette, 5 by 7 in., 650 pages. Price, $2.

Maintenance Hints is a handbook designed to be a quick, complete and convenient guide to modern maintenance practices on all types of electrical equipment.

Divided into two sections, the first 17 chapters cover specific apparatus maintenance, the last seven cover general maintenance of materials used in apparatus, such as insulation.

All chapters in the manual have been extensively revised. In particular, the new edition contains a chapter on maintenance of static controls, said to be the first such information ever published in a general handbook. The chapters on electronics and electric brakes have been altered and enlarged.

NO INJURIOUS FUMES . . .

ANTI-BORAX

No. 2 BRAZING FLUX

For Brass, Bronze, Copper, Steel, Malleable Iron, etc. Causes the bronze to penetrate deeper into the joint—making a stronger union than is possible with other fluxes. High efficiency makes it more economical to use. Melting point 300°.

ALSO

1—Cast Iron Welding Flux
3—Brass, Bronze Welding Flux
4—Flux for Bronze Welding Cast Iron
5—Extra Quality Aluminum Flux for Cast Aluminum Welding
7—Steel Flux
8—Aluminum Flux for Sheet Aluminum
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys Dow Metal, etc.
16—Silver Solder Paste Flux

FOR THE BEST JOB AT LEAST COST

Welders can save more money and get a better job on production work, making special tools, and repair work with the right Anti-Borax product—**order by number.** Send for **free sample** and descriptive Circular.

ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

Just You TRY to Break a

THERMO Spiral

TIP CLEANER

The exclusive, non-breakable advantage of THERMO TIP cleaners didn't just happen—No Sir. This feature resulted after 10 years research, and experience. That's why we say no other type or make can match a THERMO, and the best way to prove that statement is to send for a FREE THERMO Spiral Tip Cleaner and put it to every test—as to its cleaning efficiency and long lasting performances. Yes, just TRY to break it—then you'll know why—

All progressive Welding Supply dealers Recommend
THERMO TIP CLEANERS

THERMACOTE COMPANY
108 S. DeLacey Ave., PASADENA, CALIFORNIA

30 YEARS AGO

(Taken from the WELDING ENGINEER of June, 1929)

—30 YEARS AGO—

H. E. Rockefeller of Linde Co. is assisting in the direction of shop and field welding during construction of the Research Building of Union Carbide Co. at Niagara Falls.

—30 YEARS AGO—

Westinghouse Electric & Mfg. Co. has recently announced a new line of 300 and 400 amp single operator arc welding generators of the belted and coupled type.

—30 YEARS AGO—

Another arc welded pipeline is being constructed, this one by A. O. Smith Corp., Milwaukee. The El Paso line will stretch from Jal, N. M., to El Paso, Tex.

—30 YEARS AGO—

The 326 workmen at the Boeing Airplane plant in Seattle, Wash., complete as many as two fuselages a day. All the joints in the units are arc welded, with some small components gas welded and brazed.

—30 YEARS AGO—

The American Welding Society has completed a Fusion Welding and Gas Cutting Code for Building Construction.

—30 YEARS AGO—

The number of buildings constructed using arc welding has increased by 50% during the past year.

—30 YEARS AGO—

Frank Fetherston, CGMA, and John Crowe of Airco, brought in the low golf scores at the Compressed Gas Manufacturer's Association recent summer meeting in Absecon, N. J.

—30 YEARS AGO—

Arthur Friese, Welding Engineering Co., Milwaukee, has announced his company is a new distributor of Hansen arc welders.

—30 YEARS AGO—

Linde Air Products Co. recently opened oxygen producing plants in Oklahoma City and Jacksonville, Fla.

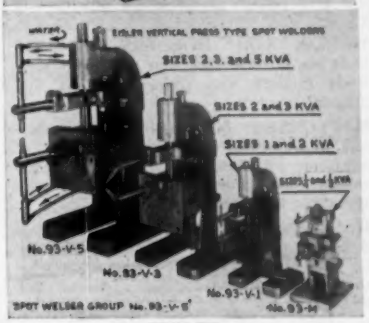
—30 YEARS AGO—

An editorial says, "An excellent way to improve employment conditions in welding departments is to give practical encouragement to welding schools who maintain a high grade of instruction for new operators."

EISLER VERTICAL TYPE PRESS WELDERS

We also make a complete line of Spot and Wire Butt Welders.

Write for Cat. No. 93-57



EISLER ENGINEERING CO., INC.
Charles Eisler Jr., President
749 So. 13th St., Newark 3, N. J.

When You Weld Cast Iron Select the Correct

Fuse-Well

CAST IRON WELDING RODS OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

free literature . . . . . use card on page 105

75. COPPER WELD ALLOYS—All State Welding Alloys Co., Inc. Folder describes alloys and fluxes for use on copper and copper bearing alloys. Serves as operating guide.

76. X-RAY UNIT—Balteau Electric Corp. Illustrated literature on Baltograph 180 describes various industrial applications of this portable radiograph unit.

77. COLD PRESSURE WELDING—Koldweld Div., Kelsey-Hayes Co. Brochure on process and hand-operated bench model tool is available.

78. CLAMP-TYPE AMMETERS—Columbia Electric Mfg. Co. Catalog of complete line gives details on ammeters that measure a-c/d-c. Incudes prices and shipping weights.

79. ELECTRODE HOLDERS—Lenco Inc. Data sheet illustrates four high-amp electrode holders with parts-breakdown diagrams.

80. FLUXLESS SOLDERING — Aeroprojects Inc. Bulletin SB-5 shows full line of ultrasonic fluxless soldering equipment, varying from hand to high production units applicable to many materials.

81. SPRAYED COATINGS — Metallizing Engineering Co., Inc. Illustrated Bulletin 136A gives basic engineering data on wire and powder sprayed coatings of metals and ceramics.

82. NITROGEN FLUSHING — National Cylinder Gas Div. Use of nitrogen for flushing molten metals is described in information report 19.

83. NON-ACID FLUX—Fairmount Chemical Co., Inc. Specific applications and technical data on use of Hydrazine flux are available.

84. GAS CONTAINERS—Ronan & Kunzl Inc. Information sheet LX-58 pictures 10 types of liquefied gas containers, gives history of Cryotainer, and applications.

85. ELECTRODES—Champion Rivet Co. Booklet describes iron powder contact welding electrodes. Specifications are included.

86. STUD WELDING UNIT—KSM Products Inc. Folder illustrates and gives specifications for the percussive stud welding unit PS-1, heavy duty.

87. WELDING GOGGLES—Sellstrom Mfg. Co. Bulletin 35-E gives all details on Model 500 plastic eyecup welding goggles.

88. WELDING MATERIAL USES—Linde Co. Booklet F-5756-H specifies welding wires, welding composition, backing composition and surface build-up materials as used in submerged-arc welding.

89. CONTROL UNITS—Oilgear Co. Bulletin 36300 illustrates and describes construction of company's preset dial units which can store variable preset command signals.

90. MACHINE TOOL — Sheffield Corp. Data sheet on electric discharge machine tool Model 500 ED gives specifications for generator, dielectric pump, and machine tool base.

91. AUTOMATED WELDING — Cayuga Machine & Fabricating Co., Inc. Catalog 800 pictures and explains these processes: hot water tank production, transformer tank lugs, shell welding, motor core lamina welding, motor frames, brake drums, and turbine blade welding.

92. NICKEL BASE ALLOY—Wall Colmonoy Corp. Data sheet 22 gives properties and applications of Nicrobraz 50, new brazing alloy.

93. INSPECTION—Picker X-Ray Corp. Illustrated booklet shows use of X and gamma rays for nondestructive inspection and product testing.

94. ADHESIVES—Chemical Development Corp. Bulletin and price list is available covering high strength epoxy bonding agents. Besides bonding, adhesives are used to seal and fill gaps.

95. CABINET DOOR WELDER—R. W. Hoffman Co., Inc. Flyer illustrates automatic metal cabinet door welder with electronic timing device.

96. TRANSPARENT NOZZLES—Tec Torch Co., Inc. Flyer 88 describes four different welding nozzles with welding temperature capacities of 2,200 to 3,100 F.

97. ANGLE COMPUTER — Big Midget Products. Circular details pocket-size pipe angle computer that gives correct angle and length for cutting pipe.

98. SPONGE IRON PROCESS—M. W. Kellogg Co. Brochure explains new HyL process for converting iron ore into sponge iron for use in place of pig or scrap iron.

99. WALL CHART — Carborundum Co. Handy wall chart illustrates and specifies for: die barbering wheels; sticks, stones and rubs; and finishing compounds.

100. COLD DRAWN WIRES—Sylvania Electric Products, Inc. Booklet describes properties and applications of company's alloy, plated and clad fine wires. Includes factors that determine specific applications.

101. ANALYSIS EQUIPMENT—Magnetic Analysis Corp. Bulletin 100 explains use of magnetic analysis multi-frequency equipment for non-destructive inspection of non-ferrous and non-magnetic metals.

102. OXYGEN CUSHION VALVE—Chek-Shock Mfg. Co. Flyer illustrates and specifies operation of brass oxygen cushion valve, which controls initial surge of high pressure gas from tank.

103. PARTS FABRICATION—Airline Welding & Engineering. Brochure describes company's facilities for contract production and fabrication of precision metallic parts and structures.

104. COATED ELECTRODES — Welding Equipment & Supply Co. Data sheet gives applications for Eurekaweld 1000 coated electrodes and 1000-A bare wire for use in welding high-strength tool steels in missile industry.

105. PROTECTIVE EQUIPMENT — Kedman Co. Eight data and price sheets show complete line of welding helmets, face shields, goggles, eyeshields, gloves, etc.

106. WELDING CLAMPS—Wetzler Clamp Co., Inc. Pocket-size catalog describes band, bar, cross, drill press, pipe and other types of weldors' clamps.

107. SUCTION CLEANERS—Clements Mfg. Co. Bulletin describes line of blower-suction cleaners in weights varying from 7 to 14 lb. Full line of attachments is included.

108. WELDING POSITIONERS—Harnischfeger Corp. Booklet pictures and describes nine heavy duty models, 3,000 to 100,000 lb capacity.

109. DESTATICIZERS — Merix Chemical Co. Folder lists line of anti-static compound concentrates in liquid form, with many business and industrial applications specified.

110. RADIATION INSPECTION—Universal Technical Testing Laboratories, Inc. Illustrated brochure discusses value of X-ray and gamma ray inspection.

111. FLOW METER—Waukee Engineering Co. Illustrated brochure 204 gives specifications for company's instrument that measures air and industrial gases.

112. NITROGEN GENERATOR — Philips Electronics Inc. Flyer RC-280 illustrates and gives specifications for Norelco liquid-nitrogen generator. Manufacturer claims usual losses by evaporation are substantially reduced.

113. PROPANE DILUTER—Selas Corp. of America. Bulletin PD-1 presents units that mix propane or butane with air to supply standby fuel and maintain heating when regular gas supply is curtailed.

114. SEAM WELDER—Sciaky Bros. Inc. Bulletin 316-7 describes type MP 1, air operated, press type, single phase seam welder. Includes machine data and dimensional drawings.

115. TANDEM ARC WELDING—Lincoln Electric Co. Brochure explains tandem arc welding applications, processes, and equipment requirements.

116. WELDING ELECTRODES—Dobbins Mfg. Co. Illustrated bulletin with specifications shows a wide range of electrode tips for resistance welding and circuit-breaking contacts.

117. GRINDING MACHINES—Norton Co. General catalog describes company's line of precision grinding and lapping machines, with catalog numbers listed for specific machines.

118. CARBON - GRAPHITE — Stackpole Carbon Co. Catalog 40-B gives performance and applications data for wide range of carbon and graphite products. Mechanical, chemical, electrical and refractory applications are described.

119. METAL CLEANING—E. I. du Pont de Nemours & Co. Booklet explains method for quickly analyzing and comparing metal cleaning costs.

120. ENGINEERING SERVICE—Chicago Bridge & Iron Co. Illustrated brochure B-42 describes coordinated engineering, fabrication and erection services offered by company. Included are storage and pressure vessels, Hortonclad and special alloy structures.

121. SPOT WELDER CONTROL—Taylor-Winfield Corp. Bulletin 10-613 explains counting tube type of precision control for tri-phase spot welders.

122. ARC WELDING PACKAGE—National Electric Welding Machines Co. Combination Mig or Tig arc welder, manipulator and control is fully described in Vol. 11, No. 5 issue of company's publication "Welding News".

123. REPAIR PRODUCTS—Devcon Corp. Industrial application bulletin 3 illustrates 11 solutions to customers' repair problems with Plastic Steel.

124. COMPRESSORS—Joy Mfg. Co. Bulletin covers complete line of heavy duty low pressure compressors. Specifications on three models, 756 to 7,392 cfm, and a sectional drawing are included.

125. SPECIAL GLASSES — Magna Co. Folder explains how prescription Magna-Lens eliminate need for conventional glasses for weldors.

CLASSIFIED EMPLOYMENT • BUSINESS • OPPORTUNITIES

THE WELDING SHOPPER

ADVERTISING • EQUIPMENT—USED and RESALE

HELP WANTED

Linde Distributor in Southern California area needs additional experienced salesman for gases and equipment. All replies strictly confidential. Write Box No. 653, c/o Welding Engineer, 5826 Dempster Street, Morton Grove, Ill.

WELDING ENGINEER WANTED

Medium-size steel fabricator located in Chicago is in need of a welding engineer who is familiar with the setup and all phases of fusion welding.

Prefer man familiar with arc welding operations involving inert gas, submerged arc, Spot and Heil-Arc.

Manual, semi-automatic and automatic setups.

Knowledge of welding metallurgy beneficial but not necessary.

Excellent opportunity for capable man. Our employees know of this ad. Write Box No. 654, c/o Welding Engineer, 5826 Dempster Street, Morton Grove, Ill.

WELDING ENGINEER

The Armour Research Foundation has an opening for an experienced welding engineer. Applicants should have several years of experience in welding and brazing research with at least a B.S. degree in Welding or Metallurgy.

The Foundation is located on the campus of the Illinois Institute of Technology and encourages graduate engineering study through its education program providing tuition free graduate study, in addition to offering competitive salaries and liberal benefits including generous relocation allowance and vacation program.

Please send complete resume to:

A. J. Paneral
ARMOUR RESEARCH Foundation
of Illinois Institute of Technology
10 West 35th Street
Chicago 16, Illinois

WELDING ENGINEER

Development of methods for welding, brazing and other similar methods of joining NEW AND DIFFERENT materials to themselves and to each other

Development of techniques for fabrication of SPECIAL AND UNUSUAL materials

B.S. in Welding Engineering; Mechanical, Metallurgical Engineering, or Metallurgy with interest in welding and 1-5 years experience

Employee benefits, educational assistance, family relocation expenses. Homes and apartments in a variety of settings. Excellent school systems

Send resumé or letter of interest to

CENTRAL EMPLOYMENT OFFICE
Technical Personnel
UNION CARBIDE NUCLEAR COMPANY
a Division of
UNION CARBIDE CORPORATION
Post Office Box P, Oak Ridge, Tennessee

SCHOOL

"UPGRADE" YOUR WELDING OPERATORS. Send them to Hobart's non-profit welding school. Specialized training for code tests and all phases of welding, manual and automatic. Newest and most completely equipped school in the country. Low tuition. Write Hobart Welding School, Box U-692, Troy, Ohio.

EQUIPMENT FOR SALE

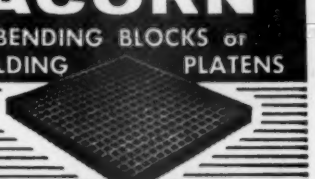
HEAVY DUTY TURNING ROLLS
for rotating pressure vessels, pipe and cylindrical bodies for welding
Aronson
MACHINE CO., ARCADE, N.Y.
A COMPLETE LINE of WELDING POSITIONERS

WELDING PLATENS
STAHL EQUIPMENT CO.
94 Washington St. Brookline 46, Mass.

METALLIZING WIRES
Rigidly Specified For
METAL SPRAYING
Spra-Rod CORPORATION
2795 East 83rd St. • Cleveland, Ohio • LOngacre 1-7168

CUTTING MACHINES, AIRCO Cameo & Radiographs and NATIONAL No. 5.
SEAM WELDER, Progressive, 150 KVA, New
SPOT WELDER, National, 40 KVA, Used.
CUTTING TORCHES, Used, Oxweld, Airco, Harris.
WELDING TORCHES, New, Rego GV.
BRONZE—STAINLESS—AMPCOTRODES
ELECTRODE HOLDERS.
RALL SUPPLY CO. 51 E. 42nd St., N.Y.C. 17

FOR SALE OR RENT
(Or rent with purchase option)
More than 400 Lincoln 300-amp. electric motor-driven welding machines. Locations: Pennsylvania, Wisconsin, Illinois, Michigan, Utah, Alabama, Louisiana, Texas, Oklahoma. Rental rate: $30 per month. Latest models. Also 20 Lincoln 200-amp. gas-driven welders available in Florida.
Write, Wire, Phone:
CONTINENTAL EQUIPMENT RENTAL CO.
523 S. 6th St. Milwaukee, Wisconsin
Telephone-Broadway 3-6589

ACORN
BENDING BLOCKS or WELDING PLATENS

ACORN
IRON & SUPPLY CO.
901 N. Delaware Ave., Phila. 23, Pa.

WHERE TO BUY

9814 Beronice, Schiller Park, Ill.
(in metropolitan Chicago area)

BUSINESS OPPORTUNITY

WANTED
Active partner to eventually take over management of Custom Flame Cutting Shop in Los Angeles' fast growing steel fabricating market.
Equipment includes: 7-torch oxygraph, two radiographs, etc. Should have business or sales experience, preferably in custom cutting.
Requires investment of $10,000. Write Box No. 652 c/o Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

BOOKS

Bigger-Better – NEW 1959
. . . the 2nd edition is just off the press. Get your copy now . . .

This cross-indexed volume contains 126 of the best Data Sheets appearing in WELDING ENGINEER in the past 15 years. Yet it costs only $1.40!

See your welding supply distributor or use coupon below.

WELDING ENGINEER
P.O. Box 28, Morton Grove, Ill.

Please send me_____copies of the Welding Engineer Data Sheets. I enclose ☐ check ☐ money order ☐ Bill me.

Name_____
Address_____
City_____ Zone_____ State_____
Company_____
Title_____

AD INDEX

This advertisers' index is included as a convenience and is in no way a part of the advertising contract. Although every care has been taken to index accurately, some errors may have occurred and no allowance will be made for them.

Air Reduction Sales Co. 41
Air Reduction Sales Co. Tuffaloy Dept. 90
Alloy Rods Co. 40
All-State Welding Alloys Co., Inc. 88
American Chain & Cable Co., Inc. Page Steel & Wire Div. 14
American Optical Co. 80
Ampco Metal, Inc. 68
Anti-Borax Compound Co. 101
Arcos Corp. 82, 83
Atlas Welding Accessories Inc. 34

Bay State Abrasive Products Co. 36, 37
Becker Bros. Carbon Co. 91

Cambridge Co. 15
Cam-Lok Div. 87
Carol Cable Co. ..... Inside Front Cover
Chicago Boiler Co. 96
Chicago Hardware Foundry Co. 101
Columbia Electric Mfg. Co. 100
Contour Marker Corp. 99, 100
Coyne Cylinder Co. 97

Dockson Corp. 92
Duro Engineering Co. 73

Eastman Kodak Co. 63
Eisler Engineering Co. 101
Engwald Corp. 92
Eutectic Welding Alloys Corp. 71

H & M Pipe Beveling Machine Co. 96
Harnischfeger Corp. 65
Harris Calorific Co. 16
Hobart Bros. Co. 1, 2

International Nickel Co. ..... 12, Back Cover

Jackson Products ..... Front Cover
Johns-Manville Corp. 64

Lenco, Inc. 93
Lincoln Electric Co. 10, 11
Linde Co. 42
Lummis Mfg. Co. 99

P. R. Mallory & Co. Inc. 35
Merrill Brothers 79
Metalloy Products Co. 97
Miller Electric Mfg. Co., Inc. 38

National Carbide Co. 88
National Welding Equipment Co. 9
Norton Co. 5

Page Steel & Wire Division American Chain & Cable Co., Inc. 14
Phelps Dodge Copper Products Corp. 67

Rankin Mfg. Co. 4
Riegel Textile Corp. 95
Ruemelin Mfg. Co. 97

A. O. Smith Corp. 17-32
Shawinigan Products Corp. 79
Singer Glove Mfg. Co. 96
Special Chemicals Corp. 91
Stoody Co. 61
Stulz-Sickles Co. 90

Tec Torch Co., Inc. 33
Tempil Corp. 89
Tennessee Fabricating Co. 60
Thermacote Co. 101
Tuffaloy Dept. of Airco 90
Tweco Products, Inc. ..... Inside Back Cover

United Specialties Inc. 84

Victor Equipment Co. 6, 44

Welsh Mfg. Co. 99
Westinghouse Electric Co. 75
Welding Engineer 77

York Engineering Co. 93

Literature offered in ads

150. Air Reduction Sales Co.—Further information available on the new Airco H35-B Heliweld holder.

151. Alloy Rods Co.—Bulletin HS-102 on the "Wear-O-Matic" process is available.

152. All-State Welding Alloys Co., Inc.—Write for information on fluxes custom coated on your own rods, and 58 page instruction manual.

153. American Optical Co.—Write for further information on head, eye, body and hand protection with AO's products.

154. Ampco Metal, Inc.—Bulletin W-17 gives detailed facts on "Ampco-Trode" electrode and bronze weldrods.

155. Anti-Borax Compound Co.—Descriptive circular and free sample of brazing flux available.

156. Atlas Welding Accessories, Inc.—Further data available on the Atlas wide-blade "Tomahawks."

157. Bay State Abrasive Products Co.—Information available on the new "Bayflex" double-duty grinding and finishing wheels.

158. Becker Brothers Carbon Co.—Catalog available on "Keen-Cut" electrodes, carbon rods and plates, welding paste, graphite cores and chills and graphite powder.

159. Cambridge Co.—Write for bulletin CS19 on "Liqua-Guard System" for liquefied atmospheric gases.

160. Cam-Lok Div.—Bulletin No. 301 on the complete line of Receptacles and plugs is available.

161. Carol Cable Co.—Information on Carol's "Dynapower" welding cable.

162. Chicago Boiler Co.—Complete details on the "Red Head" lifting clamps available.

163. Chicago Hardware Foundry Co.—Information on "Fuse-Well" cast-iron welding rods and electrodes available.

164. Columbia Electric Mfg. Co.—Illustrated catalog on tong-test ac/dc ammeter.

165. Contour Marker Corp.—Write for information on laying out pipe joints and establishing and marking a point at any angle.

166. Coyne Cylinder Co.—Write for details on Coyne's acetylene cylinders.

167. Dockson Corp.—Write for Head & Eye Protection Catalog and name of your nearest distributor.

168. Duro Engineering Co.—Information on the standard holder and the "Durogon" holder.

169. Eastman Kodak Co.—Folder available, "13 minute processing for industrial x-ray films" and name of your local dealer.

170. Eisler Engineering Co., Inc.—Catalog 93-57 on spot and wire butt welders and the vertical type press welder.

171. Engwald Corp.—Catalog WE-6 available on Engwald welding fume exhausters.

172. Eutectic Welding Alloys Corp.—Further information available on Eutectic's low temperature welding alloys.

173. H & M Pipe Beveling Machine Co.—Illustrated catalog and specification sheets on "H & M" machines designed to meet your pipe cutting and beveling needs.

174. Harnischfeger Corp.—Write for bulletin "HF Welders" for inert gas welding.

175. Harris Calorific Co.—Write for a demonstration and further information on the Harris universal pressure welding torch No. 43 and the No. 49 cutting attachment.

176. Hobart Brothers Co.—Write for further information on Hobart's Power/Weld, the new versatile welder.

177. Hobart Brothers Co.—Further information on Hobart electrodes available.

178. International Nickel Co., Inc.—Further information on Inco's "141" Nickel Electrodes and "61" Nickel Filler Wire available.

179. International Nickel Co., Inc.—Useful booklet tells how others are welding dissimilar metals with Inco-Weld "A" products.

180. Jackson Products—Write for information on Jackson's insulated electrode holder, the "Quik-Trik" cable connector and the "Cablehitch" for overhead suspension of welding cable.

181. Johns-Manville Corp.—Brochure TX-2A available on J-M aluminized asbestos cloth.

182. Lenco, Inc.—Information on connecting welding cable.

183. Lincoln Electric Co.—For a complete description of the Idealarc "TM" welders write for Lincoln Bulletin 4607.1.

184. Linde Co.—Complete facts on the new portable, compact "Sigmette" torch.

185. Lummis Mfg. Co.—Catalog available on "Key-Bak's."

186. P. R. Mallory & Co., Inc.—Write for further information on Mallory's electrodes.

187. Merrill Brothers—Further information available on material handling devices.

(Continued on page 106)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 85 to 93

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

USE POSTPAID CARD →

★ For copies of any manufacturers bulletins described on these pages circle the number of the items or card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 85.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

★**Post card not valid after three (3) months. After that, write *directly to the manufacturer*, describing fully the information and/or literature wanted.**

Name_____ Title_____

Company_____

Address_____

City_____ State_____ 6/59

NOT GOOD AFTER SEPTEMBER 1, 1959

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 104)

188. Metalloy Products Co.—Testing samples of "Galvalloy" available for your galvanizing job.

189. Miller Electric Mfg. Co., Inc.—Full particulars will be sent on the new gas driven welder/power plant, and a demonstration can be arranged.

190. National Carbide Co.—Write for further information on calcium carbide and name and address of your nearest distributor.

191. National Welding Equipment Co.—Catalog form 14 available, describing compound pressure cylinder manifold for industrial and medical cylinder gases.

192. Norton Co.—Further information available on the Norton "44-B11" wheels and how it can benefit your weld grinding.

193. Page Steel & Wire Div.—Folders available on submerged arc and inert gas automatic welding wire and a detailed analyses of automatic welding wires.

194. Phelps Dodge Copper Products Corp.—Further information on Phelps Dodge "Habirprene" arc welding cable.

195. Rankin Mfg. Co.—Write for a Ranite Select-O-Graph Guide, for easy rod selection.

196. Riegel Textile Corp.—Catalog available on Riegel gloves.

197. Ruemelin Mfg. Co.—Detailed information available on the Ruemelin fume collector.

198. Shawinigan Products Corp.—Information on calcium carbide and name of your local distributor.

199. Singer Glove Mfg. Co.—Catalog available on Singer's welding gloves and safety clothing.

200. A. O. Smith Corp.—Further information on A. O. Smith's welding machines available.

201. Special Chemicals Corp.—Write for further information on "Kwikflux" for silver brazing and hard soldering.

202. Stoody Co.—Literature available on Stoody semi-automatic hard-facing.

203. Stulz-Sickles Co.—Complete details on "Manganal" applicator bars and welding electrodes and name of your nearest distributor.

204. Tec Torch Co., Inc.—Information on the "Visuweld" torch, the Tec spot gun and Tec spot control are available.

205. Tempil Corp.—Sample of Tempil pellets and information on "Tempilstik" available.

206. Tennessee Fabricating Co.—New catalog on castings, tubing, stampings, primers and finishes, garden furniture and machine tools and supplies.

207. Thermacote Co.—Information on Thermo Spiral Tip Cleaner plus a free sample.

208. Tuffaloy Dept., Air Reduction Sales Co.—Catalog and prices on Tuffaloy spot welding tips, tip holders and adapters.

209. Tweco Products, Inc.—Write for "Twecolog" showing the complete line of Tweco Accessories.

210. United Specialties Inc.—Information on "Weldreel" hose and cable reels.

211. Victor Equipment Co.—Write for further information on Victor's cutting torches and tips.

212. Victor Equipment Co.—Victor Hard-facing Manual available also dealerships.

213. Welsh Mfg. Co.—Write for further information on Welsh's new goggles for weldors.

214. Westinghouse Electric Corp.—Write for further information on the "Baltospot" portable x-ray unit.

215. York Engineering Co.—Information available on York's "Spat-R-Pruf" compound, to eliminate spatter grinding after welding.

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Name_____ Title_____

Company_____

Address_____

City_____ State_____ 6/59

NOT GOOD AFTER SEPTEMBER 1, 1959

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

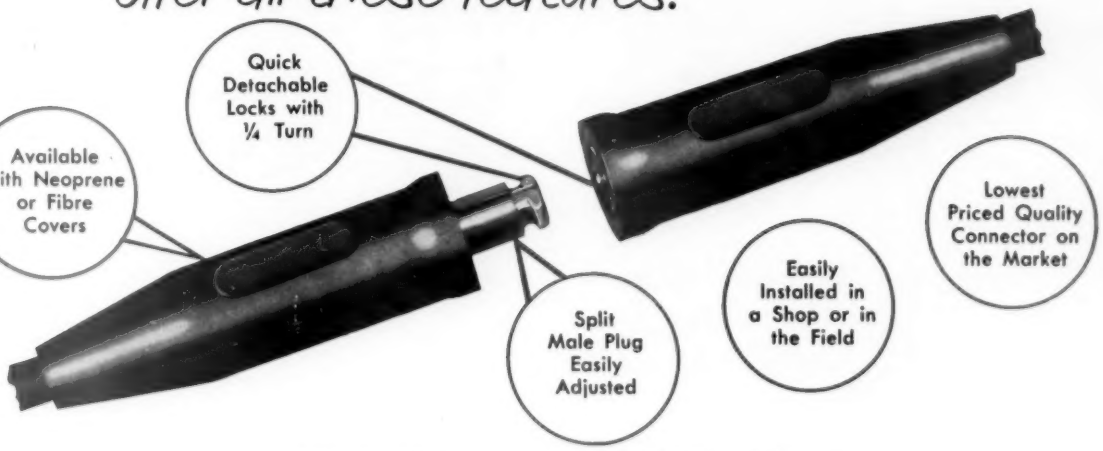
Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

DOWN-TO-EARTH FACTS about cable connectors

Add On Cable — Take Off Cable
Use Shorter Cables — Save Wear
Save Welding Operator's Time
Remove Cable — Prevent Theft
For Quick Detachable Whip Cables
Splice Cable — Repair Cable

Only TWECO CABLE CONNECTORS offer all these features:


Quick Detachable Locks with ¼ Turn
Available with Neoprene or Fibre Covers
Split Male Plug Easily Adjusted
Easily Installed in a Shop or in the Field
Lowest Priced Quality Connector on the Market

SOL-CON — *Solder Type*

MEC-CON — *Mechanical Type*

TWECO GROUND CLAMPS

WRITE FOR FREE TWECOLOG SHOWING THE COMPLETE LINE OF TWECO ACCESSORIES

TWECOTONG ELECTRODE HOLDERS

Tweco

MANUFACTURERS: ARC WELDING ELECTRODE HOLDERS, GROUND CLAMPS, CABLE CONNECTORS, TWECO-LITE ALUMINUM WELDING CABLE

PRODUCTS, INC.

P. O. BOX 666 • Factory: Boston at Mosley • Phone AMherst 5-1684 • Wichita 1, Kansas

So versatile it joins Nickel to 304, Nickel to mild steel equally well! It's Inco-Weld "A"!

Same unique Inco welding product (electrode or wire) successfully welds 97% of all dissimilar alloy combinations.

The weldor pictured above is TIG welding a 9/16-inch Grade "A" Nickel bottom shell to a 5/32-inch Type 304 (18/8) stainless steel outer shell to complete a 600-gallon steam-jacketed kettle.

When the picture was taken, the fabricator, J. C. Pardo & Son of Schenectady, N. Y. was also completing a similar kettle formed of Nickel and mild steel.

In *both* jobs, joining procedures and materials were *exactly* the same . . . initial tacking with Inco-Weld* "A" Electrode (that's the one with the green flux coating) . . . finish welding with cut lengths of Inco-Weld "A" filler wire (inert gas). In *both* jobs, the welds are sound, strong and as corrosion-resisting as the most corrosion-resisting parent metal.

Would these procedures and materials have succeeded with other dissimilar alloy combinations?

In most cases . . . yes! Inco-Weld "A" (electrode or wire) gives a high-quality weld in 97% of all dissimilar alloy combinations. Only rarely is a pre-heat or post-heat necessary.

Imagine what this versatility can mean to you. Simplification all around . . . in stockroom, in methods, in quality control . . . even in weldor training.

Learn how much others are doing with Inco-Weld "A" welding products. Send for Inco's useful booklet, "Now You Can Weld Dissimilar Alloys Quickly and Easily".

*Registered trademark

You can join all of these . . . and many others . . . with Inco-Weld "A" Electrode and Wire

- 304 to Monel* Nickel-copper Alloy
- 304 to Carbon Steel
- Carbon Steel to Monel Alloy
- Carbon Steel to Inconel* Nickel-Chromium Alloy
- Nickel to Carbon Steel
- Nickel to 304
- Inconel Alloy to Hastelloy "C" Alloy
- 10% Ni-Clad Steel to 10% Ni-Clad Steel
- Inconel Alloy to itself

The International Nickel Company, Inc.
67 Wall Street — New York 5, N. Y.

INCO WELDING PRODUCTS

electrodes • wires • fluxes